Refine Search

Search Results -

Term	Documents
(9 NOT 7).PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD.	35
(L9 NOT L7).PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD.	35

Database:
US Pre-Grant Publication Full-Text Database
US Patents Full-Text Database
US OCR Full-Text Database
EPO Abstracts Database
JPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

Search: L10

Refine Search

Recall Text Clear Interrupt

Search History

DATE: Wednesday, April 26, 2006 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=ADJ		
L10	L9 not l7	35	L10
L9	l5 and fuel cell	141	L9
L8	L7 not l6	65	L8
L7	l3 and fuel cell	106	L7
L6	l3 with fuel cell	41	L6
L5	L2 and l1	449	L5
L4	L2 same l1	377	L4
L3	L2 with l1	363	L3
L2	exotherm$4 with (generat$4 or produc$5) with (hydrogen or H?sub.2)	2173	L2
L1	endotherm$4 with (generat$4 or produc$5) with (hydrogen or H?sub.2)	1339	L1

END OF SEARCH HISTORY

WEST Search History

Hide Items | Restore | Clear | Cancel

DATE: Wednesday, April 26, 2006

Hide?	Set Name	Query	Hit Count
		DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=ADJ	
☐	L10	L9 not l7	35
☐	L9	l5 and fuel cell	141
☐	L8	L7 not l6	65
☐	L7	l3 and fuel cell	106
☐	L6	l3 with fuel cell	41
☐	L5	L2 and l1	449
☐	L4	L2 same l1	377
☐	L3	L2 with l1	363
☐	L2	exotherm$4 with (generat$4 or produc$5) with (hydrogen or H?sub.2)	2173
☐	L1	endotherm$4 with (generat$4 or produc$5) with (hydrogen or H?sub.2)	1339

END OF SEARCH HISTORY

Access DB# 173455

SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: Raymond Alejandro Examiner # : 76895 Date: 12/02/05
Art Unit: 1745 Phone Number ~~30~~ 2-1282 Serial Number: 10/086904
Mail Box and Bldg/Room Location: Rem. 6B-59 Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

****

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: Thermally Efficient Hydrogen Storage System

Inventors (please provide full names): Jon Gelsey

Earliest Priority Filing Date: 02/28/02

**For Sequence Searches Only* Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.*

Please, search for the subject matter of claims 65-83 and 85-98.

****

STAFF USE ONLY	**Type of Search**	**Vendors and cost where applicable**
Searcher: EJ	NA Sequence (#)	STN $ 447.24
Searcher Phone #:	AA Sequence (#)	Dialog
Searcher Location:	Structure (#) ✓ (1)	Questel/Orbit
Date Searcher Picked Up:	Bibliographic ✓ (and)	Dr. Link
Date Completed: 12-9-05	Litigation	Lexis/Nexis
Searcher Prep & Review Time: 10	Fulltext	Sequence Systems
~~Clerical Prep Time:~~	Patent Family	WWW/Internet
Online Time: 110	Other	Other (specify)

PTO-1590 (8-01)

```
=> file reg
FILE 'REGISTRY'
USE IS SUBJECT TO THE TERMS OF YOUR STN CUSTOMER AGREEMENT.
PLEASE SEE "HELP USAGETERMS" FOR DETAILS.
COPYRIGHT (C) 2005 American Chemical Society (ACS)



=> display history full l1-


     FILE 'LCA'
L1         32138 SEA (PRODUC? OR PROD# OR GENERAT? OR MANUF? OR MFR# OR
                 CREAT? OR FORM## OR FORMING# OR FORMAT? OR MAKE# OR
                 MADE# OR MAKING# OR FABRICAT? OR SYNTHESI? OR PREPAR? OR
                 PREP#)/BI,AB
L2           605 SEA (HYDROGEN# OR H2 OR H)(2A)(PRODUC? OR PROD# OR
                 GENERAT? OR MANUF? OR MFR# OR CREAT? OR FORM## OR
                 FORMING# OR FORMAT? OR MAKE# OR MADE# OR MAKING# OR
                 FABRICAT? OR SYNTHESI? OR PREPAR? OR PREP#)

     FILE 'HCA'
L3        253088 SEA (HYDROGEN# OR H2 OR H)(2A)(PRODUC? OR PROD# OR
                 GENERAT? OR MANUF? OR MFR# OR CREAT? OR FORM## OR
                 FORMING# OR FORMAT? OR MAKE# OR MADE# OR MAKING# OR
                 FABRICAT? OR SYNTHESI? OR PREPAR? OR PREP#)

     FILE 'REGISTRY'
                 E HYDROGEN/CN
L4             1 SEA HYDROGEN/CN

     FILE 'HCA'
L5         34339 SEA L4/P
L6         14629 SEA (L4 OR H2 OR HYDROGEN# OR H)(2A)(STORE# OR STORING#
                 OR STORAG?)
L7         52928 SEA FUELCELL? OR FUEL?(2A)(CELL OR CELLS)
L8         42463 SEA EXOTHERM?
L9         23026 SEA ENDOTHERM?
L10       359138 SEA ?HYDRID?
L11         7657 SEA L8 AND L9
L12          426 SEA L11 AND (L3 OR L5 OR L6)
L13           88 SEA L11 AND L7
L14           66 SEA L13 AND L12
L15            4 SEA L14 AND L10

     FILE 'REGISTRY'
L16      2624562 SEA (M(L)H)/ELS
L17        18361 SEA L16 AND ?HYDRID?/CNS
```

```
L18        8567 SEA L17 NOT C/ELS

     FILE 'HCA'
L19       42413 SEA L18
L20           2 SEA L14 AND L19
L21       16986 SEA (L4 OR HYDROGEN# OR H2 OR H)(2A)GENERAT?
L22          15 SEA L14 AND L21

     FILE 'HCAPLUS'
L23           1 SEA GELSEY J?/AU

     FILE 'REGISTRY'
L24           1 SEA CARBON/CN
L25           1 SEA PLATINUM/CN
L26           1 SEA ALUMINUM/CN
L27           1 SEA COPPER/CN

     FILE 'HCA'
L28      308639 SEA L24
L29      134127 SEA L25
L30      366923 SEA L26
L31      496786 SEA L27
L32          17 SEA L14 AND (L28 OR L29 OR L30 OR L31)
L33          27 SEA L15 OR L20 OR L22 OR L32
L34          39 SEA L14 NOT L33
L35          19 SEA L33 AND (1840-2002/PY OR 1840-2002/PRY)
L36          22 SEA L34 AND (1840-2002/PY OR 1840-2002/PRY)

     FILE 'WPIX, JAPIO'
L37       11212 SEA EXOTHERM?
L38        4346 SEA EXOTHERM?
     TOTAL FOR ALL FILES
L39       15558 SEA EXOTHERM?
L40        4306 SEA ENDOTHERM?
L41        2140 SEA ENDOTHERM?
     TOTAL FOR ALL FILES
L42        6446 SEA ENDOTHERM?
L43       52150 SEA (HYDROGEN# OR H2 OR H)(2A)(PRODUC? OR PROD# OR
                GENERAT? OR MANUF? OR MFR# OR CREAT? OR FORM## OR
                FORMING# OR FORMAT? OR MAKE# OR MADE# OR MAKING# OR
                FABRICAT? OR SYNTHESI? OR PREPAR? OR PREP#)
L44       22033 SEA (HYDROGEN# OR H2 OR H)(2A)(PRODUC? OR PROD# OR
                GENERAT? OR MANUF? OR MFR# OR CREAT? OR FORM## OR
                FORMING# OR FORMAT? OR MAKE# OR MADE# OR MAKING# OR
                FABRICAT? OR SYNTHESI? OR PREPAR? OR PREP#)
     TOTAL FOR ALL FILES
L45       74183 SEA L3
L46        5705 SEA (H2 OR HYDROGEN# OR H)(2A)(STORE# OR STORING# OR
```

```
                STORAG?)
L47         5021 SEA (H2 OR HYDROGEN# OR H)(2A)(STORE# OR STORING# OR
                STORAG?)
     TOTAL FOR ALL FILES
L48        10726 SEA (H2 OR HYDROGEN# OR H)(2A)(STORE# OR STORING# OR
                STORAG?)
L49        33996 SEA FUELCELL? OR FUEL?(2A)(CELL OR CELLS)
L50        20164 SEA FUELCELL? OR FUEL?(2A)(CELL OR CELLS)
     TOTAL FOR ALL FILES
L51        54160 SEA FUELCELL? OR FUEL?(2A)(CELL OR CELLS)
L52       104315 SEA ?HYDRID?
L53        33253 SEA ?HYDRID?
     TOTAL FOR ALL FILES
L54       137568 SEA ?HYDRID?
L55          996 SEA L37 AND L40
L56          336 SEA L38 AND L41
     TOTAL FOR ALL FILES
L57         1332 SEA L39 AND L42
L58          146 SEA L55 AND (L43 OR L46)
L59           34 SEA L56 AND (L44 OR L47)
     TOTAL FOR ALL FILES
L60          180 SEA L57 AND (L45 OR L48)
L61           66 SEA L55 AND L49
L62           16 SEA L56 AND L50
     TOTAL FOR ALL FILES
L63           82 SEA L57 AND L51
L64           37 SEA L61 AND L58
L65            7 SEA L62 AND L59
     TOTAL FOR ALL FILES
L66           44 SEA L63 AND L60
L67            4 SEA L64 AND L52
L68            0 SEA L65 AND L53
     TOTAL FOR ALL FILES
L69            4 SEA L66 AND L54
L70         9750 SEA (HYDROGEN# OR H2 OR H)(2A)GENERAT?
L71         6795 SEA (HYDROGEN# OR H2 OR H)(2A)GENERAT?
     TOTAL FOR ALL FILES
L72        16545 SEA (HYDROGEN# OR H2 OR H)(2A) GENERAT?
L73           13 SEA L64 AND L70
L74            4 SEA L65 AND L71
     TOTAL FOR ALL FILES
L75           17 SEA L66 AND L72

     FILE 'JAPIO'
L76            7 SEA L65 OR L74
L77            6 SEA L76 AND (1900-2002/PY OR 1900-2002/PRY)

     FILE 'WPIX'
```

L78 15 SEA L67 OR L73
L79 14 SEA L78 AND (1900-2002/PY OR 1900-2002/PRY)

=> file japio
FILE 'JAPIO'

FILE LAST UPDATED: 7 DEC 2005 <20051207/UP>
FILE COVERS APR 1973 TO JULY 28, 2005

=> d 177 1-6 ibib abs ind

L77 ANSWER 1 OF 6 JAPIO (C) 2005 JPO on STN
ACCESSION NUMBER: 2003-272696 JAPIO
TITLE: SOLID OXIDE **FUEL CELL** **CELL** STACK AND GENERATING METHOD USING THE SAME
INVENTOR: ENDO NAOE; YOKOO MASAYUKI; TAKE TETSUO
PATENT ASSIGNEE(S): NIPPON TELEGR & TELEPH CORP <NTT>
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2003272696	A	20030926	Heisei	H01M008-24

APPLICATION INFORMATION
STN FORMAT: JP 2002-78623 20020320
ORIGINAL: JP2002078623 Heisei
PRIORITY APPLN. INFO.: JP 2002-78623 **20020320**
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2003
AN 2003-272696 JAPIO
AB PROBLEM TO BE SOLVED: To provide a solid oxide **fuel cell** **cell** stack having a high generating efficiency and a generating method using the same.
SOLUTION: This is a solid oxide **fuel cell** **cell** stack which has laminated by coupling a POSOFC cell 1 that generates electricity by carrying out partial oxidation reaction (**endothermic** reaction) of hydrocarbon and a SOFC cell 2 that generates electricity by carrying out oxidation reaction (**exothermic** reaction) of carbon monoxide and hydrogen using as a fuel the gas containing carbon monoxide and **hydrogen** that is **generated** in the above reaction.
In the solid oxide **fuel cell** **cell** stack 5, at least one POSOFC 1 is interposed between two SOFC cells

2.

IC ICM H01M008-24
ICS H01M008-00; H01M008-06; H01M008-12

L77 ANSWER 2 OF 6 JAPIO (C) 2005 JPO on STN
ACCESSION NUMBER: 2003-132919 JAPIO
TITLE: **FUEL CELL** GENERATOR AND ITS OPERATING METHOD
INVENTOR: KOMATSU TAKESHI; TAKE TETSUO
PATENT ASSIGNEE(S): NIPPON TELEGR & TELEPH CORP <NTT>
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2003132919	A	20030509	Heisei	H01M008-04

APPLICATION INFORMATION
STN FORMAT: JP 2001-327427 20011025
ORIGINAL: JP2001327427 Heisei
PRIORITY APPLN. INFO.: JP 2001-327427 **20011025**
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2003
AN 2003-132919 JAPIO
AB PROBLEM TO BE SOLVED: To provide a **fuel cell** generator that can shorten starting time while lowering generation cost and use heat efficiently, and its operating method.
SOLUTION: This **fuel cell** generator 1 has a fuel processing apparatus 20 that **forms hydrogen**-rich fuel gas from feed fuel and a FC stack 10 that generates electricity using the fuel gas and oxidizer gas supplied, further comprising an **endothermic** reactor 52 that conducts processing for chemically storing heat discharged from the FC stack through **endothermic** reaction in which acetone and **hydrogen** are **formed** from isopropanol, an **exothermic** reactor 54 that conducts processing for picking up heat stored through **exothermic** reaction in which isopropanol is formed from acetone and hydrogen after the **endothermic** reaction, and an **exothermic** reactor (54) that supplies the heat picked up to the fuel processing apparatus 20.

IC ICM H01M008-04
ICA H01M008-10

L77 ANSWER 3 OF 6 JAPIO (C) 2005 JPO on STN
ACCESSION NUMBER: 1995-335238 JAPIO
TITLE: FUEL REFORMER, OPERATING METHOD THEREOF AND **FUEL CELL** DEVICE

INVENTOR: KOTOGAMI YOSHIHIDE; SUGIMOTO TERUO; SATO MINORU
PATENT ASSIGNEE(S): MITSUBISHI ELECTRIC CORP
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 07335238	A	**19951222**	Heisei	H01M008-06

APPLICATION INFORMATION
STN FORMAT: JP 1994-127551 19940609
ORIGINAL: JP06127551 Heisei
PRIORITY APPLN. INFO.: JP 1994-127551 **19940609**
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1995

AN 1995-335238 JAPIO

AB PURPOSE: To improve start-up and load response, further to make a device compact, and also to improve fuel conversion efficiency into hydrogen, by laminating a partial oxidation reaction part and a reform reaction part through a heat transfer plate.
CONSTITUTION: As reforming material gas 4, hydrocarbon or alcohol material and steam are supplied to a reform reaction part 27, to generate reform reaction which is **endothermic** reaction. As premixing fuel 28, hydrocarbon or alcohol material and air are supplied to a partial oxidation reaction part 32, to generate partial oxidation reaction which is **exothermic** reaction. Generated heat by the partial oxidation reaction is transmitted to the part 27 by a heat transfer plate 22 provided between the parts 27, 32, to perform efficient supply of reaction heat. Thus by supplying heat necessary for reform reaction without using a thermal medium heating furnace and thermal medium circulating system, a device is miniaturized also to **produce hydrogen** from both parts 27, 32, consequently, a **hydrogen production** quantity per volume can be increased.

IC ICM H01M008-06
ICS C01B003-32; C01B003-38; H01M008-04

L77 ANSWER 4 OF 6 JAPIO (C) 2005 JPO on STN
ACCESSION NUMBER: 1994-111838 JAPIO
TITLE: REFORMER, REFORMING SYSTEM, AND **FUEL CELL** SYSTEM
INVENTOR: FURUYA TOMIAKI; SHIRATORI MASAYUKI; SHIMIZU SEISABURO; KUREMATSU KAZUHIKO; HANAKADA YOSHIO
PATENT ASSIGNEE(S): TOSHIBA CORP
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC

JP 06111838 A **19940422** Heisei H01M008-02

APPLICATION INFORMATION
STN FORMAT: JP 1992-261415 19920930
ORIGINAL: JP04261415 Heisei
PRIORITY APPLN. INFO.: JP 1992-261415 **19920930**
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1994
AN 1994-111838 JAPIO
AB PURPOSE: To miniaturize a reformer, by forming reforming catalysts on the grooves of one side plate and combustion catalysts on the grooves of the other side plate respectively, and supplying heat required for reforming reaction with these plates alternately laminated to be adopted as a fluid passage.
CONSTITUTION: Reforming catalysts 6 are formed on the surfaces of grooves formed in a plate 1, and combustion catalysts 5 are formed on the surfaces of the grooves of a plate 2. The plates 1 and 2 are alternately laminated to supply fuel, composed of a mixture of a compound, including a hydrocarbon group, and water, to a fluid passage 3, formed by a surface having the grooves of the plate 1 and a surface having no groove of the plate 2; and **hydrogen** is **generated** by catalysts 6. Fuel and oxygen-containing fluid are supplied to a fluid passage 4 to cause catalyst combustion reaction by the catalyst 5. That is, **exothermic** reaction and **endothermic** reaction are concurrently caused at positions adjoined vertically to supply heat, required for reforming reaction, by combustion reaction. Consequently, reforming reaction is made without a burner, and moreover an auxiliary facility such as a reaction tank, heat insulating material, and a reaction pipe is eliminated for miniaturization.

IC ICM H01M008-02
ICS C01B003-38; H01M008-06

L77 ANSWER 5 OF 6 JAPIO (C) 2005 JPO on STN
ACCESSION NUMBER: 1989-167958 JAPIO
TITLE: INTERNALLY REFORMING TYPE MOLTEN CARBONATE **FUEL CELL**
INVENTOR: YAMAMOTO YOHEI; TAKAHASHI HIROFUMI
PATENT ASSIGNEE(S): TOKYO GAS CO LTD
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 01167958	A	**19890703**	Heisei	H01M008-02

APPLICATION INFORMATION
STN FORMAT: JP 1987-327997 19871223

ORIGINAL: JP62327997 Showa
PRIORITY APPLN. INFO.: JP 1987-327997 **19871223**
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1989

AN 1989-167958 JAPIO

AB PURPOSE: To lengthen the life of a cell by making a reforming catalyst face the oxidizing agent electrode of an adjacent unit **fuel cell** through a separator and arranging no oxidizing agent passage between the reforming catalyst and the oxidizing agent electrode.
CONSTITUTION: When fuel containing hydrocarbon and steam are supplied to a fuel passage 13, fuel reforming reaction arises by a reforming catalyst 14 to **produce hydrogen**, carbon monoxide, and carbon dioxide. The amount of heat necessary for reforming reaction is supplied to the reforming catalyst 14 from an oxidizing agent electrode 12, in which **exothermic** reaction arises, through an electrolyte matrix 16 and a fuel electrode 11, and at the same time from the oxidizing agent electrode 12 of an adjacent unit **fuel cell.** Since an oxidizing agent passage 15 does not exist between the reforming catalyst 14 and the oxidizing agent electrode 12 of the adjacent unit **fuel cell**, the reforming catalyst 14 locates in the nearest place to the oxidizing agent electrode 12 of the adjacent unit **fuel cell**, and heat is effectively transferred to the reforming catalyst 14 from the oxidizing agent electrode 12. The temperature drop of the reforming catalyst caused by **endothermic** reforming reaction is prevented and the condensation of electrolyte vapor on the reforming catalyst is retarded.

IC ICM H01M008-02
ICS H01M008-06

L77 ANSWER 6 OF 6 JAPIO (C) 2005 JPO on STN
ACCESSION NUMBER: 1986-190867 JAPIO
TITLE: **FUEL CELL** POWER GENERATING SYSTEM
INVENTOR: EGUCHI TOMOKI
PATENT ASSIGNEE(S): TOSHIBA CORP
NIPPON NENRYO GIJUTSU KAIHATSU KK
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 61190867	A	**19860825**	Showa	H01M008-06

APPLICATION INFORMATION
STN FORMAT: JP 1985-31012 19850219

```
    ORIGINAL:               JP60031012          Showa
PRIORITY APPLN. INFO.:      JP 1985-31012       19850219
SOURCE:                     PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined
                            Applications, Vol. 1986
AN    1986-190867    JAPIO
AB    PURPOSE: To increase the total heat efficiency of system by
      supplying heat generated by power generation to a
      hydrogen generating part for methanol
      decomposition.
      CONSTITUTION: The heat generated by power generation in a
      fuel cell 6 is given to a heating medium 10
      through a cooler 9 and supplied to a heater 3 inside a reactor 1
      with a pump 11 for methanol decomposition. The endothermic
      reaction in the reactor 1 is combined with exothermic in
      the fuel cell 6 for keeping heat balance, and
      the heat is effectively utilized to increase the total efficiency of
      a system.
      COPYRIGHT: (C)1986,JPO&Japio
IC    ICM  H01M008-06
      ICS  H01M008-04


=> file wpix
FILE 'WPIX'
COPYRIGHT (C) 2005 THE THOMSON CORPORATION

FILE LAST UPDATED:           8 DEC 2005      <20051208/UP>
MOST RECENT DERWENT UPDATE:     200579        <200579/DW>
DERWENT WORLD PATENTS INDEX SUBSCRIBER FILE, COVERS 1963 TO DATE


=> d l79 1-14 max

L79   ANSWER 1 OF 14  WPIX  COPYRIGHT 2005 THE THOMSON CORP on STN
AN    2004-256364 [24]   WPIX
DNC   C2004-100063
TI    Conducting chemical reaction, e.g. water-gas shift reaction in
      single stage process channel, by flowing reactants through first
      reaction zone in the channel, and flowing unreacted reactants and
      intermediate product through second zone.
DC    A17 C04 E19 E35 E36 H04 J04
IN    DAYMO, E; JAROSCH, K; MARCO, J; MAZANEC, T; PENG, Y; SIMMONS, W W;
      TONKOVICH, A L; MARCO, J L; PAUL JAROSCH, K T; JAROSCH, K T P
PA    (DAYM-I) DAYMO E; (MARC-I) MARCO J L; (MAZA-I) MAZANEC T; (JARO-I)
      PAUL JAROSCH K T; (PENG-I) PENG Y; (SIMM-I) SIMMONS W W; (TONK-I)
      TONKOVICH A L; (VELO-N) VELOCYS INC
CYC   106
```

PI US 2004034111 A1 20040219 (200424)* 16 C07C027-26
WO 2004016346 A1 20040226 (200424) EN B01J019-00
RW: AT BE BG CH CY CZ DE DK EA EE ES FI FR GB GH GM GR HU IE IT KE LS LU MC MW MZ NL OA PT RO SD SE SI SK SL SZ TR TZ UG ZM ZW
W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NI NO NZ OM PG PH PL PT RO RU SC SD SE SG SK SL SY TJ TM TN TR TT TZ UA UG UZ VC VN YU ZA ZM ZW
AU 2003257944 A1 20040303 (200457) B01J019-00
EP 1536884 A1 20050608 (200537) EN B01J019-00
R: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LT LU LV MC MK NL PT RO SE SI SK TR
US 6969505 B2 20051129 (200578) C01B003-26

ADT US 2004034111 A1 US 2002-219956 20020815; WO 2004016346 A1 WO 2003-US23890 20030731; AU 2003257944 A1 AU 2003-257944 20030731; EP 1536884 A1 EP 2003-788295 20030731, WO 2003-US23890 20030731; US 6969505 B2 US 2002-219956 20020815

FDT AU 2003257944 A1 Based on WO 2004016346; EP 1536884 A1 Based on WO 2004016346

PRAI **US 2002-219956 20020815**

IC ICM B01J019-00; C01B003-26; C07C027-26
ICS C07C027-06

AB US2004034111 A UPAB: 20040408

NOVELTY - An equilibrium limited chemical reaction is conducted in a single stage process channel (20) by flowing reactants (10) through a first reaction zone in the process channel under a first set of reaction conditions to produce an intermediate product, and flowing unreacted reactants and the intermediate product through a second reaction zone in the process channel under a second set of reaction conditions to produce the final product.

DETAILED DESCRIPTION - Conducting an equilibrium limited chemical reaction in a single stage process channel to make a desired product, involve:

(a) flowing reactants through a first reaction zone in the single stage process channel under a first set of reaction conditions to produce an intermediate product comprising the desired product; and

(b) flowing unreacted reactants and the intermediate product through a second reaction zone in the process channel under a second set of reaction conditions to produce the final product. The first set of reaction conditions is suitable for producing a first theoretical equilibrium product, and the second set reaction conditions are suitable for producing a second theoretical equilibrium product. The second theoretical equilibrium product has a higher concentration of the desired product than the first theoretical equilibrium product.

An INDEPENDENT CLAIM is also included for an apparatus comprising array of single stage process microchannels arranged in rows extending parallel to each other, a catalyst (30) being contained within each single stage process microchannel; and array of heat exchange channels arranged in rows extending parallel to each other, with the heat exchange channels extending transversely of the single stage process microchannels, and the rows of heat exchange channels and the rows of single stage process microchannels being positioned in separate alternating planes.

USE - The invention is used for conducting equilibrium limited chemical reaction in single stage process channel to make desired product. The chemical reaction includes an acetylation addition reaction, alkylation, dealkylation, hydrodealkylation, reductive alkylation, animation, ammonia synthesis, aromatization, arylation, autothermal reforming, carbonylation, decarbonylation, reductive carbonylation, carboxylation, reductive carboxylation, reductive coupling, condensation, cracking, hydrocracking, cyclization, cyclooligomerization, dehalogenation, dimerization, epoxidation, esterification, Fischer-Tropsch reaction, halogenation, hydrohalogenation, homologation, hydration, dehydration, hydrogenation, dehydrogenation, hydrocarboxylation, hydroformylation, hydrogenolysis, hydrometallation, hydrosilation, hydrolysis, hydrotreating, isomerization, methylation, demethylation, metathesis, methanol synthesis, nitration, oxidation, partial oxidation, polymerization, reduction, reformation, reverse water gas shift, sulfonation, telomerization, transesterification, trimerization, Sabatier reaction, carbon dioxide reforming, preferential oxidation, or preferential methanation. **H2** from **product** of water-gas shift reaction is used to operate **fuel cell** (60); to hydrogenate, hydrotreat, hydroalkylate, hydrocrack, or hydrodesulfurize a feedstock; reacted to **form hydrogen** chloride, **hydrogen** bromide, ethanol, methanol or ammonia; to make metal **hydride**; to hydrogenate fat or oil; to reduce metal ore; or reduce a catalyst. (all claimed)

ADVANTAGE - The two-stage water-gas shift reaction is conducted in a single stage process channel where the contact time within the process channel may be 10-1000 mseconds. These reactors have reaction zones that are on the order of 1/3-1/900 the size of conventional processing hardware for the same production output.

DESCRIPTION OF DRAWING(S) - The figure is a schematic flow sheet of a process for conducting equilibrium limited chemical reaction.

Reactants 10

Process channel 20

Entrance 21

Catalyst 30

Product 40

Coolant fluid 50
Fuel cell 60
Dwg.2/5

TECH US 2004034111 A1UPTX: 20040408

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Components: The reactants comprise carbon monoxide (CO) and water (H2O), and the **product** (40) comprises **hydrogen** (H2) gas and carbon dioxide (CO2). The catalyst comprises noble metal and/or transition metal; and/or oxide of alkali metal, alkaline earth metal, boron, gallium, germanium, arsenic, selenium, tellurium, thallium, lead, bismuth, polonium, magnesium, titanium, vanadium, chromium, manganese, iron, nickel, cobalt, copper, zinc, zirconium, molybdenum, tin, calcium, aluminum, silicon, lanthanum series element. It comprises a zirconia supported alkali metal modified ruthenium catalyst; cupric oxide; zinc oxide; or aluminum oxide. It comprises a support consisting of alumina, silica, titania or zirconia. It comprises platinum, palladium, copper, iron, rhodium, gold, rhenium, or its oxide. It comprises a transition metal carbide, nitride or boride, or oxygen containing its analog. It comprises a support that is impregnated with a reducible metal oxide. The reducible metal oxide comprises an oxide of chromium, vanadium, molybdenum, neodymium, praseodymium, titanium, iron, nickel, manganese, cobalt, and/or cerium. The catalyst is in the form of particulate solids having a median particle diameter of 60-1000 microm. The catalyst comprises a porous support, interfacial layer, catalytic material, and optionally buffer layer. The catalyst is in the form of foam, felt, wad, honeycomb, and/or insertable fin. The catalyst is in the form of a flow-by structure with an adjacent gap, foam with an adjacent gap, fin structure with gaps, washcoat on an inserted substrate, or a gauze that is parallel to the flow direction with a corresponding gap for flow. It is washcoated on the interior wall of the process channel. The coolant fluid (50) comprises air, steam, liquid water, carbon dioxide, gaseous nitrogen, liquid nitrogen, gaseous hydrocarbon, or oil. Preferred Compositions: The reactants comprise up to 50 mol% CO and up to 99.9 mol% H2O; or 1-20 mol% CO, 1-70 mol% H2O, 1-20 mol% CO2, and 1-75 mol% **H2**. The **product** comprises up to 99.9 mol% H2 and up to 50 mol% CO2. It comprises 0.1-30 mol% CO2, 0.1-90 mol% H2, 0.01-5 mol% CO, 40-99 mol% H2O, and up to 10 mol% CH4.

TECHNOLOGY FOCUS - CHEMICAL ENGINEERING - Preferred Process: Subsequent to step (A) but before step (B), the unreacted reactants and the intermediate product are flowed through another reaction zone in the process channel under another set of reaction conditions to produce another intermediate product comprising the desired product. The chemical reaction is an **exothermic** reaction, and the process channel is cooled with added cooling; or the chemical reaction is an **endothermic** reaction, and the process channel is heated with added heating. The reactants contact

a catalyst during step (A) and/or (B). The process channel is cooled using a cooling fluid that flows through a cooling channel in cross current, concurrent or countercurrent to the flow of reactants through the process channel. The process channel is heated using a heating fluid that flows through a heating channel in cross current, concurrent or countercurrent to the flow of reactants through the process channel. A clean-up process is conducted within and outside the process channel to remove CO from the product. The contact time of the reactants and/or product with the catalyst is 10-1000 (preferably 100) mseconds. The first zone is at 200-400 degreesC, and the second zone is at 150-3000 degreesC. The reactants are at 500 psig at the entrance to the process channel. The coolant fluid is at -200 - 400 degreesC as it enters the coolant channel. The pressure drop of the reactants and/or product through the process channel is up to 40 psi/foot of length of the process channel. The process is conducted in a reactor containing single stage process channels operating in parallel, the process **producing hydrogen** at a rate of at least10 (preferably at least100) standard liters per minute per liter of volume of the single stage process channels in the reactor. The total pressure drop for the coolant flowing through the coolant channels is up to 1 psi or 10 inches of water. **H2** in the **product** is purified using preferential oxidation reactor, membrane separation of hydrogen or carbon monoxide, sorption based separation system, or methanation reactor.

TECHNOLOGY FOCUS - MECHANICAL ENGINEERING - Preferred Apparatus: The process channel is a microchannel. The process channel has an entrance (21), an exit and an elongated section extending between the entrance and the exit. It further comprises additional entrance(s) in the elongated section.

TECHNOLOGY FOCUS - METALLURGY - Preferred Materials: The single stage process channels and heat exchange channels are made of steel, aluminum, titanium, nickel, copper, brass, or their alloys.

TECHNOLOGY FOCUS - POLYMERS - Preferred Materials: The single stage process channels and heat exchange channels are made of polymer.

TECHNOLOGY FOCUS - CERAMICS AND GLASS - Preferred Materials: The single stage process channels and heat exchange channels are made of ceramics, glass, composites, quartz, and/or silicon.

L79 ANSWER 2 OF 14 WPIX
AN 2003-830302 [77] WPIX
DNN N2003-663411 DNC C2003-233882
TI **Hydrogen generator** for **fuel**

cells useful for portable storage device, i.e. cell phone, comprises **exothermic hydrogen generator**, and **endothermic hydrogen generator** that absorbs heat from **exothermic hydrogen generator**.

DC E36 H06 J08 L03 X16
IN GELSEY, J
PA (GELS-I) GELSEY J
CYC 1
PI US 2003162059 A1 20030828 (200377)* 8 H01M008-06
ADT US 2003162059 A1 US 2002-86904 20020228
PRAI **US 2002-86904 20020228**
IC ICM H01M008-06
ICS C01B003-02
AB US2003162059 A UPAB: 20031128

NOVELTY - A **hydrogen generator** comprises an **exothermic hydrogen generator** (140), and an **endothermic hydrogen generator** (120). The **endothermic hydrogen generator** absorbs heat from the **exothermic hydrogen generator**.

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for a method of **generating hydrogen**, comprising **generating hydrogen** by an **exothermic** process; and **generating hydrogen** by an **endothermic** process.

USE - For **fuel cells** for a portable storage device, i.e. cell phones, laptop computers, video cameras, flashlights, portable electrical, tools, or personal digital assistants.

ADVANTAGE - The inventive **hydrogen generator** uses both **endothermic** and **exothermic hydrogen generators**. The **exothermic hydrogen generator** transfers heat to the **endothermic hydrogen generator**

DESCRIPTION OF DRAWING(S) - The figure shows an exemplary apparatus comprising **exothermic** and **endothermic hydrogen generators**.

First compartment 110
Endothermic hydrogen generator 120
Second compartment 130
Exothermic hydrogen generator 140
Ports 106, 170
Dwg.1/2

TECH US 2003162059 A1UPTX: 20031128

TECHNOLOGY FOCUS - ELECTRICAL POWER AND ENERGY - Preferred Apparatus: The apparatus further comprises a **fuel**

cell coupled to the **endothermic** and
exothermic hydrogen generators, and a
portable electronic device coupled to the **fuel**
cell. The **fuel cell** is thermally neutral
or is **endothermic**.
Preferred Component: The **exothermic hydrogen**
generator comprises a **borohydride** solution, solid
lithium aluminum **tetrahydride**, and/or a partial oxidation
hydrocarbon reformer (preferably sodium **borohydride**
hydrogen generator and a catalyst).
The **endothermic hydrogen generator**
comprises metal **hydride**(s), metal alloy **hydride**
(s), a carbon nanotube system, compressed hydrogen gas, liquid
hydrogen and a steam hydrocarbon reformer (preferably metal
hydrides).
Preferred Method: The **exothermic** process comprises
releasing hydrogen from a metal **hydride**.
Preferred Condition: The production of heat by **exothermic**
process and the absorption of heat by the **endothermic**
process are approximately equal.

L79 ANSWER 3 OF 14 WPIX COPYRIGHT 2005 THE THOMSON CORP on STN
AN 2003-815061 [77] WPIX
DNN N2003-652369 DNC C2003-227043
TI Hydrogen **fuel cell** has inlets for fuel and
oxidants and outlets for product gas and oxidation catalytic layer
with flat side facing a porous dosing disc for homogenous mixing.
DC E36 H04 H06 L03 X16
IN PORTSCHER, M; SCHUESSLER, M
PA (BALL-N) BALLARD POWER SYSTEMS AG
CYC 31
PI EP 1350562 A1 20031008 (200377)* GE 8 B01J019-24
R: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LT
LU LV MC MK NL PT RO SE SI SK TR
DE 10214293 A1 20031016 (200377) B01J008-00
ADT EP 1350562 A1 EP 2003-5348 20030312; DE 10214293 A1 DE 2002-10214293
20020328
PRAI **DE 2002-10214293 20020328**
IC ICM B01J008-00; B01J019-24
ICS B01J012-00; C01B003-32; C01B003-38; C01B003-58; H01M008-06
AB EP 1350562 A UPAB: 20031128
NOVELTY - A reactor combines two heterogenic processes which are an
endothermic catalytic process and an **exothermic**
catalytic reaction. Reactants flow through a thin horizontal, porous
catalytic reforming disc joined to an oxidation catalytic layer. The
layer has inlets for fuel and oxidants and outlets for the product
gas. The oxidation catalytic layer has a flat side facing a porous

dosing disc.

DETAILED DESCRIPTION - A reactor combines two heterogenic processes which are an **endothermic** catalytic process and an **exothermic** catalytic reaction. Reactants flow through a thin horizontal, porous catalytic reforming disc (1, 3) joined to an oxidation catalytic layer (2, 4). The layer has inlets (6) for fuel and oxidants and outlets for the product gas. The oxidation catalytic layer (2, 4) has a flat side facing a porous dosing disc (7, 9). Reformed product emerges homogeneously from the oxidation catalytic layer (2, 4), and the oxidation agent emerges homogeneously from the dosing disc (7, 9) face. A CO oxidation zone (2, 4) is thermally linked to a reforming zone (1, 3), and the oxidant is discharged over the reforming catalytic disc (1, 3), through which the educt flows at right angles. The reforming catalytic disc (1, 3) occupies the oxidation catalytic layer (2, 4) surface. The dosing disc (7, 9) is hollow and has a gas-tight rim and a porous, flat surface. Oxidant flows at right angles to the oxidation catalytic layer in contact with the dosing disc. Two reforming catalytic layers are positioned either side of a fuel chamber (6). The stack has a dosing disc (7, 9) each side. Also claimed is a manufacturing process.

USE - **Fuel cell** for **generation** of **hydrogen** and electricity.

ADVANTAGE - The assembly achieves a generally homogenous mixture of oxygen and reformed product over the oxidation catalytic layer. Further claimed is that the assembly generally prevents a reverse reaction.

DESCRIPTION OF DRAWING(S) - The drawing shows a cross sectional view of the cell.

Reforming catalytic disc 1, 3
oxidation catalytic layer 2, 4
Component 5
inlet 6
Component 7
Component 8
Component 9
Component 10
Component 11
Component 12
product gas outlet 13, 14
stack direction S
Dwg.1/3

KW [1] 97153-0-0-0 CL; 783-0-0-0 CL; 217-0-0-0 CL
FS CPI EPI
FA AB; GI; DCN
MC CPI: E31-A01; E31-D02; H04-E06; H04-F02E; H06-A03; L03-E04F; N07-C; N07-L03A
EPI: X16-C15; X16-C17

```
DRN  1423-U; 1532-U; 1779-U
CMC  UPB   20031128
     M3   *01* C101 C550 C810 M411 M424 M740 M782 M904 M905 Q413 Q454 R013
               DCN: R01532-K; R01532-M
     M3   *02* C106 C108 C550 C730 C800 C801 C802 C803 C805 C807 M411 M424
               M740 M782 M904 M905 M910 Q413 Q454 R013
               DCN: R01423-K; R01423-M
     M3   *03* C108 C550 C810 M411 M424 M740 M782 M904 M905 M910 Q454 Q507
               R013
               DCN: R01779-K; R01779-M
```

L79 ANSWER 4 OF 14 WPIX

```
AN   2003-430390 [40]   WPIX
DNN  N2003-343585        DNC C2003-113815
```

TI Process and installation for the **generation** of **hydrogen**, useful for **fuel cell** applications, involves a high temperature conversion process between water vapor and a fuel.

```
DC   E36 H04 H06 L03 X16
IN   BOUDJEMAA, F; FALEMPE, M; GROUSSET, D; MARTY, P; GROUSET, D
PA   (ARME) ARMINES ASSOC RECH DEV METHODES; (RENA) RENAULT; (ARME)
     ARMINES; (RENA) RENAULT SAS
CYC  102
PI   WO 2003035545   A1 20030501 (200340)* FR   45    C01B003-32
        RW: AT BE BG CH CY CZ DE DK EA EE ES FI FR GB GH GM GR IE IT KE
            LS LU MC MW MZ NL OA PT SD SE SK SL SZ TR TZ UG ZM ZW
         W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ
            DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP
            KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ
            NO NZ OM PH PL PT RO RU SD SE SG SI SK SL TJ TM TN TR TT TZ
            UA UG US UZ VC VN YU ZA ZM ZW
     FR 2831532      A1 20030502 (200340)             C01B003-32
     EP 1441980      A1 20040804 (200451)  FR         C01B003-32
         R: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR IE IT LI LT LU
            LV MC MK NL PT RO SE SI SK TR
     AU 2002358858   A1 20030506 (200461)             C01B003-32
ADT  WO 2003035545 A1 WO 2002-FR3688 20021025; FR 2831532 A1 FR
     2001-13892 20011026; EP 1441980 A1 EP 2002-793189 20021025, WO
     2002-FR3688 20021025; AU 2002358858 A1 AU 2002-358858 20021025
FDT  EP 1441980 A1 Based on WO 2003035545; AU 2002358858 A1 Based on WO
     2003035545
```

PRAI **FR 2001-13892 20011026**

```
IC   ICM  C01B003-32
     ICS  C01B003-48
ICA  H01M008-00
AB   WO2003035545 A UPAB: 20030624
```

NOVELTY - Process for the **generation** of **hydrogen**

by a homogeneous reaction of water vapor with one or more fuels, notably petrol, gas oil, butane or propane and/or natural gas and/or vegetable oils, esters or alcohols. The conversion results in a hydrogen-rich mixture with carbon monoxide by an **endothermic** reaction.

DETAILED DESCRIPTION - Process for the **generation** of **hydrogen** by a homogeneous reaction of water vapor with one or more fuels, notably petrol, gas oil, butane or propane and/or natural gas and/or vegetable oils, esters or alcohols. The conversion results in a hydrogen-rich mixture with carbon monoxide by an **endothermic** reaction. The conversion process is effected at a high temperature of 1600-2400 K in the absence of a catalyst and avoids the formation of soot or cokefaction. Polyaromatics contained in the fuels and intermediate products of the reaction are converted to hydrogen and carbon monoxide and/or carbon dioxide. The conversion time is between 1 ms (2200K) and 1s (1800K).

An INDEPENDENT CLAIM is also included for the installation of the process.

USE - The process is used as a localized **hydrogen generator** for use mainly in **fuel cells**.

ADVANTAGE - In mixing the fuel with water vapor to attain a molar ratio H2O/C greater than 2, cracking and cokefaction of the fuel during rise in temperature is avoided. A wide range of fuels can be used, including polyaromatics. The succession of preconversion/oxidation/conversion stages at high temperature curtails the response time of the generator, and in particular the temperature rise from cold start is considerably reduced.

DESCRIPTION OF DRAWING(S) - The figure illustrates a form of the installation (drawing includes non-English language text).

preheating zone 1
primary reactor 2
primary reaction zone 3
high velocity injectors 4
secondary reaction zone 5
cooling zone 6
Dwg.1/6

TECH WO 2003035545 A1UPTX: 20030624

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Process Details: The process comprises a primary conversion of the fuels into hydrogen (H2) and carbon monoxide (CO) by an **endothermic** reaction with water vapor, the water factor being 1.2-1.8 (the factor is the ratio of the flow rate of water vapor available to the stoichiometric value necessary for complete conversion to H2 and CO). The process also comprises a second conversion with water vapor of the methane and light hydrocarbons by an **endothermic** reaction in the presence of a catalyst specific to these hydrocarbons, and a stage of heating of the fuel and water vapor to

a high temperature to establish an **exothermic** reaction of a fraction of the fuel with air. Other stages involve a cooling of the conversion products and recovery of the thermal energy, and stages of vaporization of water and preheating of fuel, air and water vapor .These stages are coupled by a recovery exchanger to enable continuous functioning of the process. Preferably the process also involves a mixing stage prior to or during the preheating of a fraction of the fuel and water to avoid cokefaction of the fuel during temperature rise and to start the conversion reaction during the preheating stage.
Preferred Installation: The installation comprises a primary reactor (2) consisting of two zones. In the first zone (3) the fuel and water vapor are injected at high velocity (4) (25-200 m/s) to form a homogeneous mixture and initiate the reaction, and in the second zone (5) the reactants remain for a time sufficient for thermodynamic equilibrium and to achieve conversion of methane to H2 and CO. In a variant of the process, a second conversion reactor is included in the cooling zone (6) to effect the conversion of methane and light hydrocarbons in the presence of a specific catalyst.
Preferably an **exothermic** reaction of a fraction of the fuel and water vapor with air is achieved in the first zone of the primary reactor. The installation also includes a mixer for the fuel and water vapor prior to or during the preheating stage.

ABEX WO 2003035545 A1UPTX: 20030624
EXAMPLE - None given.
KW [1] 97153-0-0-0 CL PRD; 8441-0-0-0 CL; 104782-0-0-0 CL; 7382-0-0-0 CL; 114851-0-0-0 CL
FS CPI EPI
FA AB; GI; DCN
MC CPI: E31-A02; H04-E06; H06-A03; L03-E04F; N07-L03A
EPI: X16-C
DRN 0323-S; 0323-U; 0335-S; 0335-U; 0804-S; 0804-U; 1532-P; 1532-U
CMC UPB 20030624
M3 *01* C101 C550 C810 M411 M424 M720 M740 M904 M905 N104 N441 N442 N515 Q413 Q454
DCN: R01532-K; R01532-P
M3 *02* M210 M214 M231 M320 M416 M610 M620 M730 M904 M905 M910
DCN: R00804-K; R00804-S
M3 *03* M210 M213 M231 M320 M416 M610 M620 M730 M904 M905 M910
DCN: R00335-K; R00335-S
M3 *04* M210 M211 M320 M416 M610 M620 M730 M904 M905 M910
DCN: R00323-K; R00323-S
M3 *05* M423 M730 M905
DCN: RA02WN-K; RA02WN-S

L79 ANSWER 5 OF 14 WPIX
AN 2003-412341 [39] WPIX

DNN N2003-329598
TI **Fuel cell** power generating device has **exothermic** reaction device to remove heat in **generated** acetone/**hydrogen** and transmit heat back to fuel processing apparatus.
DC X16
PA (NITE) NIPPON TELEGRAPH & TELEPHONE CORP
CYC 1
PI JP 2003132919 A 20030509 (200339)* 9 H01M008-04
ADT JP 2003132919 A JP 2001-327427 20011025
PRAI **JP 2001-327427 20011025**
IC ICM H01M008-04
ICA H01M008-10
AB JP2003132919 A UPAB: 20030619
NOVELTY - An **endothermic** reaction device (52) **generates** acetone and **hydrogen** from isopropanol by **endothermic** reaction. An **exothermic** reaction device (54) arranged in latter stage of the **endothermic** reaction device, removes the heat in **generated** acetone/ **hydrogen** and transmits the heat back to the fuel processing apparatus (20).
DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included for the operating method of **fuel cell** power generating device.
USE - **Fuel cell** power generating device.
ADVANTAGE - Reduces the heating time of **fuel cell**, thereby restraining the power cost.
DESCRIPTION OF DRAWING(S) - The figure shows the structural view of the **fuel cell** power generating device.
(Drawing includes non-English language text).
fuel processing apparatus 20
endothermic reaction device 52
exothermic reaction device 54
Dwg.1/2
FS EPI
FA AB; GI
MC EPI: X16-C01; X16-C09

L79 ANSWER 6 OF 14 WPIX COPYRIGHT 2005 THE THOMSON CORP on STN
AN 2003-405408 [39] WPIX
DNN N2003-323333 DNC C2003-108157
TI **Fuel cell** system for vehicles comprises hydrogen adsorbing alloy tank, heat exchange unit, first and second passages, and control unit which heats the **fuel cell** when its temperature is equal to or lower than reference temperature.
DC E36 H06 J06 L03 Q14 X16
IN FUJITA, N

```
PA   (TOYT) TOYOTA JIDOSHA KK
CYC  32
PI   EP 1291949      A2 20030312 (200339)* EN   17    H01M008-06
         R: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR IE IT LI LT LU
            LV MC MK NL PT RO SE SI SK TR
     JP 2003086213   A  20030320 (200339)       12    H01M008-04
     US 2003049501   A1 20030313 (200339)             H01M008-06
ADT  EP 1291949 A2 EP 2002-19922 20020904; JP 2003086213 A JP 2001-271569
     20010907; US 2003049501 A1 US 2002-233585 20020904
PRAI JP 2001-271569        20010907
IC   ICM  H01M008-04; H01M008-06
     ICS  B60L011-18; H01M008-00; H01M008-10
AB   EP   1291949 A UPAB: 20030619
```

NOVELTY - **Fuel cell** system comprises a hydrogen adsorbing alloy tank, a heat exchange unit, a first passage to allow hydrogen gas from the hydrogen tank to flow into the **fuel cell**, a second passage connecting the first passage and the hydrogen adsorbing alloy tank, and control unit which heats the **fuel cell** when its temperature is equal to or lower than reference temperature.

DETAILED DESCRIPTION - **Fuel cell** system comprises a hydrogen tank and a **fuel cell** connected and adapted to receive **hydrogen** gas and **generate** electric power; a hydrogen adsorbing alloy tank (300) connected to receive the hydrogen gas from the hydrogen tank and adapted to adsorb the received hydrogen gas in the hydrogen adsorbing alloy and to discharge the hydrogen gas from the hydrogen adsorbing alloy to the **fuel cell**; a heat exchange unit (58, 60) connected and adapted to circulate a heat exchange medium to the **fuel cell** and the hydrogen adsorbing alloy tank to cause heat exchange at least between the **fuel cell** and the hydrogen adsorbing alloy tank; a first passage (50) connecting the hydrogen tank and the **fuel cell** to allow hydrogen gas from the hydrogen tank to flow into the **fuel cell**; a second passage (54) branching from the first passage and connecting the first passage and the hydrogen adsorbing alloy tank; and a control unit which heats the **fuel cell** when its temperature is equal to or lower than a first reference temperature by supplying the hydrogen gas from the hydrogen tank to the hydrogen adsorbing alloy tank through the first passage and the second passage so that the hydrogen gas is adsorbed in the hydrogen adsorbing alloy tank with generation of heat, and transmitting the generated heat to the **fuel cell** by the heat exchange medium in the heat exchange unit. INDEPENDENT CLAIMS are also included for:

(a) a vehicle comprising a **fuel cell** system; and

(b) a method of controlling a **fuel cell** system, which involves heating the **fuel cell** when a temperature of the **fuel cell** is equal to or lower than a first reference temperature by supplying the hydrogen gas from the hydrogen tank to the hydrogen adsorbing alloy tank so that the hydrogen gas is adsorbed in the hydrogen adsorbing alloy tank with generation of heat, and transmitting the generated heat to the **fuel cell** by a heat exchange medium.

USE - The **fuel cell** system is to be mounted on a vehicle (claimed), e.g. an automobile.

ADVANTAGE - The inventive **fuel cell** is capable of controlling the temperature of a **fuel cell**. The **fuel cell** is heated with the heat **generated** when the **hydrogen** gas is adsorbed in the hydrogen adsorbing alloy tank, thus eliminating the need for an electric heater and a combustion heater as used conventionally and eliminating the need for a large-capacity battery.

DESCRIPTION OF DRAWING(S) - The figure shows the structure of a **fuel cell** system.

First passage 50

Second passage 54

Heat exchange unit 58, 60

Hydrogen adsorbing alloy tank 300

Dwg.1/4

TECH EP 1291949 A2 UPTX: 20030619

TECHNOLOGY FOCUS - ELECTRICAL POWER AND ENERGY - Preferred Parameters: The temperature of the **fuel cell** is higher than the first reference temperature and equal to or lower than a second reference temperature, and the control unit allows the **fuel cell** to use the hydrogen gas for power generation by supplying the hydrogen gas from the hydrogen tank to the **fuel cell** through the first passage, and heats the **fuel cell** by supplying the hydrogen gas from the hydrogen tank to the hydrogen adsorbing alloy tank through the first passage and the second passage so that the hydrogen gas is adsorbed in the hydrogen adsorbing alloy tank with generation of heat, and transmitting the generated heat to the **fuel cell** by the heat exchange medium in the heat exchange unit. The temperature of the **fuel cell** is higher than a third reference temperature that is higher than the first reference temperature. The first reference temperature (T1) is 0degreesC, the second reference temperature (T2) is 30-50degreesC, the third reference temperature (T3) is 50-80degreesC, and the fourth reference temperature (T4) is at least 80degreesC. The circulation path of the heat exchange medium in the heat exchange unit is configured to minimize an amount of the heat exchange medium circulating in the **fuel cell** and the hydrogen adsorbing alloy tank. The hydrogen adsorbing alloy is an alloy which

is more likely to adsorb the hydrogen gas as an internal temperature of the hydrogen adsorbing alloy decreases, and is more likely to discharge the hydrogen gas as the internal temperature increases. It is an alloy which causes an **exothermic** reaction when **storing** the **hydrogen** gas, and causes an **endothermic** reaction when discharging the hydrogen gas adsorbed in it. During operation of the **fuel cell** , the control unit is adapted to cut off supply of the hydrogen gas to the hydrogen adsorbing alloy tank and to discharge the hydrogen gas adsorbed by the hydrogen adsorbing alloy to ensure that the hydrogen adsorbing alloy tank has a capacity for s toring the hydrogen gas when operation of the **fuel cell** is completed.

KW [1] 97153-0-0-0 CL PRD PUR
FS CPI EPI GMPI
FA AB; GI; DCN
MC CPI: E11-Q01; E31-A02; H06-A03; J06-B06; L03-E04; L03-H05
EPI: X16-C09
DRN 1532-P; 1532-U
CMC UPB 20030619
M3 *01* C101 C550 C810 M411 M424 M720 M740 M904 M905 N163 N511 N512
N513 Q413 Q431 Q434 Q454 R013
DCN: R01532-K; R01532-P; R01532-P

L79 ANSWER 7 OF 14 WPIX COPYRIGHT 2005 THE THOMSON CORP on STN
AN 2001-490711 [54] WPIX
DNN N2001-363172 DNC C2001-147437
TI Compact steam reforming reactor, especially for **generating hydrogen** for a **fuel cell**, includes an **exothermic** reaction catalyst in the form of a coating.
DC E36 H04 H06 L03 X16 X21
IN BRAUCHLE, S; FISCHER, T; HEIL, D; SCHMID, W; REMSCH, T
PA (XCEL-N) XCELLSIS GMBH; (BALL-N) BALLARD POWER SYSTEMS AG; (BRAU-I) BRAUCHLE S; (HEIL-I) HEIL D; (REMS-I) REMSCH T; (SCHM-I) SCHMID W
CYC 27
PI EP 1116518 A2 20010718 (200154)* GE 8 B01J019-24 <--
R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK
NL PT RO SE SI TR
DE 10001064 A1 20010802 (200154) B01J008-00 <--
US 2001024629 A1 20010927 (200159) F28D009-00 <--
DE 10001064 B4 20040311 (200418) B01J008-00
ADT EP 1116518 A2 EP 2000-126665 20001205; DE 10001064 A1 DE 2000-10001064 20000113; US 2001024629 A1 US 2001-759251 20010116; DE 10001064 B4 DE 2000-10001064 20000113
PRAI **DE 2000-10001064 20000113**
IC ICM B01J008-00; B01J019-24; F28D009-00
ICS B01J008-02; C01B003-32; C01B003-38; C01B003-50; C01B003-58

AB EP 1116518 A UPAB: 20010924
NOVELTY - Steam reforming reactor comprises an alternating sequence of layers, each comprising a reforming zone (4) filled with an **endothermic** reforming catalyst, a heat-conducting partition (1) and a heating zone (2) containing an **exothermic** reaction catalyst in the form of a coating (3), where the volume of the reforming zone is greater than that of the heating zone.

USE - The reactor is especially useful for converting hydrocarbons or hydrocarbon derivatives (e.g. methanol) to hydrogen for use in **fuel cells**, e.g. for motor vehicles

ADVANTAGE - Incorporating the **exothermic** reaction catalyst in the form of a coating reduces the volume of the heating zone, thus providing a more compact reactor.

DESCRIPTION OF DRAWING(S) - The drawing shows a cross-sectional view of the reactor.

Partition 1
Heating zone 2
Catalyst coating 3
Reforming zone. 4
Dwg.4/5

TECH EP 1116518 A2 UPTX: 20010924
TECHNOLOGY FOCUS - ELECTRICAL POWER AND ENERGY - Preferred Reactor: The volume of the reforming zone is at least twice that of the heating zone. The **exothermic** reaction catalyst is a combustion catalyst or a carbon monoxide (CO) oxidation catalyst for selective oxidation of CO in the gas from the reforming zone(s). Each heating zone is the space between a pair of corrugated plates, and two such pairs of plates define a reforming zone. Each reforming zone contains spacers for supporting the adjacent pairs of plates.

KW [1] 97153-0-0-0 CL PRD; 15-0-0-0 CL
FS CPI EPI
FA AB; GI; DCN
MC CPI: E31-A02; H04-C02; H04-E06; H06-A; L03-E04; L03-H05
EPI: X16-C17; X21-A01F; X21-B01A
DRN 0270-S; 0270-U; 1532-P; 1532-U
CMC UPB 20010924
M3 *01* C101 C550 C810 M411 M424 M720 M740 M904 M905 N105 N209 N224 N242 N262 N441 Q413 Q417 Q431 Q454
DCN: R01532-K; R01532-P
M3 *02* H4 H401 H481 H8 M210 M211 M272 M281 M320 M416 M620 M730 M904 M905 M910
DCN: R00270-K; R00270-S

L79 ANSWER 8 OF 14 WPIX
AN 2001-204342 [21] WPIX
DNN N2001-145963 DNC C2001-060855
TI Methanol reforming catalyst with high methanol conversion rate and

low formation of carbon monoxide, comprises oxide of copper, zinc and aluminum.

DC E36 H04 H06 J04 L03 X16

IN NOJIMA, S; YASUTAKE, T

PA (MITO) MITSUBISHI HEAVY IND CO LTD; (MITO) MITSUBISHI JUKOGYO KK

CYC 28

PI EP 1077081 A2 20010221 (200121)* EN 13 B01J023-80 <--
R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK NL PT RO SE SI
CA 2315495 A1 20010211 (200122) EN B01J023-80 <--
JP 2001046872 A 20010220 (200126) 10 B01J023-80 <--
US 6576217 B1 20030610 (200340) C01B003-26
CA 2315495 C 20051025 (200571) EN B01J023-80

ADT EP 1077081 A2 EP 2000-115058 20000726; CA 2315495 A1 CA 2000-2315495 20000809; JP 2001046872 A JP 1999-227588 19990811; US 6576217 B1 US 2000-619139 20000718; CA 2315495 C CA 2000-2315495 20000809

PRAI **JP 1999-227588 19990811**

IC ICM B01J023-80; C01B003-26
ICS B01J023-835; B01J023-86; B01J035-10; C01B003-32

AB EP 1077081 A UPAB: 20010418
NOVELTY - A methanol reforming catalyst comprises an oxide containing copper, zinc and aluminum.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:

(i) the manufacture of a methanol reforming catalyst comprising reacting an aqueous solution containing copper component, an aqueous solution containing zinc component and an aqueous solution containing aluminum component with a precipitant consisting of alkaline aqueous solution, where the basic metal carbonate containing copper, zinc and aluminum is precipitated under alkaline condition and the precipitate of the basic metal carbonate is washed and sintered; and

(ii) a methanol reforming method comprising contacting a gas containing methanol, steam and oxygen with a methanol reforming catalyst to allow methanol to react with oxygen and steam to **form hydrogen** containing gas.

USE - For reforming methanol (claimed) for the **generation** of **hydrogen** used as a fuel gas for a polymer electrolyte **fuel cell** in a motor car.

ADVANTAGE - The catalyst promotes both steam reforming reaction and partial oxidation reaction simultaneously, thereby enabling high methanol conversion rate and suppress the carbon monoxide formation. Since the steam reforming reaction is **endothermic** reaction and the partial oxidizing reaction is an **exothermic** reaction, the control of balance of heat amount is made possible. Usage of a **hydrogen manufacturing** apparatus with compact size and excellent in start-up performance is enabled. The catalyst enables **manufacture** of **hydrogen**

-containing gas containing carbon monoxide in an amount less than 4%.
Dwg.0/0

TECH EP 1077081 A2 UPTX: 20010418
TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Composition: The oxide further contains at least one element selected from lanthanum, calcium, gallium, zirconium, cerium, chromium, barium and magnesium. The oxide has the composition of formula (CuO)w(ZnO)x(Al2O3)yMz, where M is at least one kind of oxide selected from lanthanum oxide, calcium oxide, gallium oxide, zirconium oxide, cerium oxide, chromium oxide, barium oxide and magnesium oxide. The molar ratios w, x, y and z are given by w = 100, x = 30-160, y = 1-50 and z = 0-30. The oxide has specific surface area as measured by BET method of 30-250 m2/g. The molar ratio of steam to methanol in gas is set to 0.4-10 and that of oxygen to methanol is set to 0.03-2.
Preferred Process: The basic metal carbonate precipitate is obtained alternatively by mixing individual aqueous solutions of copper component, zinc component, aluminum component and aqueous solution containing metal component chosen out of lanthanum, calcium, gallium, zirconium, cerium, chromium, barium and magnesium, with the precipitant to obtain basic metal carbonate containing copper, zinc, aluminum and at least one element among lanthanum, calcium, gallium, zirconium, cerium, chromium, barium and magnesium as precipitate. The basic metal carbonate is preferably obtained by mixing precipitant, individual aqueous solutions of aluminum component and zinc component and/or aqueous solution containing metal component to form the precipitate. Subsequently, aqueous solution containing copper component is added to the resultant suspension to form precipitate under alkaline condition on the surface of previously formed precipitate. The temperature of the precipitant is maintained at 15-90 degrees C. During methanol reforming, the gas is contacted with methanol reforming catalyst at 100-400 degrees C. The pressure of the gas is maintained between the atmospheric pressure and 80 atm.
Preferred Carbonate: The basic metal carbonate has a crystal structure selected from Cu2CO3(OH)2, (Cu,Zn)2CO3(OH)2, Zn4CO3(OH)6.H2O and (Cu,Zn)8Al2CO3(OH)16.H2O.
Preferred Precipitant: The precipitant consists of at least one aqueous solution selected from aqueous solution of sodium carbonate and aqueous solution of sodium bicarbonate.

ABEX EP 1077081 A2 UPTX: 20010418
EXAMPLE - Solution A (precipitant) containing 2.5 mol of sodium carbonate in 2 l of water, solution B containing 0.225 mol of zinc nitrate hexahydrate in 400 cc of water and solution C containing 0.075 mol of aluminum nitrate and 0.025 mol of cerium nitrate in 400 cc of water, were prepared. Solution D containing 0.3 mol of copper nitrate trihydrate in 200 cc of water was prepared. The mixed solution of B and C was added into solution A to form precipitate.

Then, solution D was added into the suspension to obtain double basic metal carbonate. Aging was performed for 1 hour followed by filtration and washing the precipitate. The precipitate was sintered at 300 degrees C and complex oxide containing copper, zinc, aluminum and cerium ions with specific surface area of 152 m2/g was obtained. The catalyst was evaluated for methanol reformation by molding the catalyst into pellets and loading into reactor. Test gas containing 1% of hydrogen and balance of nitrogen was supplied at 150 degrees C. Reaction gas containing evaporated methanol, steam and oxygen was supplied into the catalyst bed. The methanol conversion rate and carbon monoxide (CO) concentration was 80% and 0.3% respectively at 200 degrees C and at 250 degrees C methanol conversion rate was 91% and CO concentration was 0.5%.

```
L79  ANSWER 9 OF 14  WPIX  COPYRIGHT 2005 THE THOMSON CORP on STN
AN   2001-090901 [10]   WPIX
DNN  N2001-068907        DNC C2001-026624
TI   Hydrocarbon reformer system for producing hydrogen
     -rich product stream, useful in associated fuel
     cells, comprises first reactor, second reactor and at least
     one heat exchanger.
DC   E36 H04 J04 L03 X16
IN   BENTLEY, J M; BLOCK, S G; BOWERS, B; CHINTAWAR, P S; CLAWSON, L G;
     CROSS, J C; DAVIS, R; DORSON, M H; HAGAN, M R; KLEEBERG, G;
     MITCHELL, W L; MORRISEAU, B D; NOWICKI, B J; PAPILE, C; POLLICA, D;
     PRABHU, S; QI, F C; RIZZO, V G; RUMSEY, J W; SUN, M W; THIJSSEN, J;
     THOMPSON, C; CROSS, J C I; KLEEBURG, G; LONGO, N; RINDONE, M; RIZZO,
     V; SUN, M
PA   (LITT) LITTLE INC ARTHUR D; (NUVE-N) NUVERA FUEL CELLS; (NUVE-N)
     NUVERA FUEL CELLS INC
CYC  89
PI   WO 2000066487    A1 20001109 (200110)* EN  129    C01B003-48     <--
        RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC
            MW NL OA PT SD SE SL SZ TZ UG ZW
         W: AE AG AL AM AT AU AZ BA BB BG BR BY CA CH CN CU CZ DE DK DZ
            EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ
            LC LK LR LS LT LU LV MD MG MK MN MW MX NO NZ PL PT RO RU SD
            SE SG SI SK SL TJ TM TR TT UA UG UZ VN YU ZW
     AU 2000046975    A  20001117 (200111)             C01B003-48     <--
     EP 1181241       A1 20020227 (200222)  EN         C01B003-48     <--
         R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK
            NL PT RO SE SI
     JP 2002543033    W  20021217 (200312)      103    C01B003-48     <--
     US 6641625       B1 20031104 (200374)             B01J008-04
     AU 768496        B  20031211 (200404)             C01B003-48
     EP 1181241       B1 20050824 (200556)  EN         C01B003-48
         R: AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
```

DE 60022182 E 20050929 (200564) C01B003-48

ADT WO 2000066487 A1 WO 2000-US12117 20000503; AU 2000046975 A AU 2000-46975 20000503; EP 1181241 A1 EP 2000-928795 20000503, WO 2000-US12117 20000503; JP 2002543033 W JP 2000-615330 20000503, WO 2000-US12117 20000503; US 6641625 B1 Provisional US 1999-132184P 19990503, Provisional US 1999-132259P 19990503, US 2000-563677 20000502; AU 768496 B AU 2000-46975 20000503; EP 1181241 B1 EP 2000-928795 20000503, WO 2000-US12117 20000503; DE 60022182 E DE 2000-00022182 20000503, EP 2000-928795 20000503, WO 2000-US12117 20000503

FDT AU 2000046975 A Based on WO 2000066487; EP 1181241 A1 Based on WO 2000066487; JP 2002543033 W Based on WO 2000066487; AU 768496 B Previous Publ. AU 2000046975, Based on WO 2000066487; EP 1181241 B1 Based on WO 2000066487; DE 60022182 E Based on EP 1181241, Based on WO 2000066487

PRAI **US 2000-565288 20000502; US 1999-132184P 19990503; US 1999-132259P 19990503; US 2000-562787 20000502; US 2000-563676 20000502; US 2000-563677 20000502**

IC ICM B01J008-04; C01B003-48
ICS H01M008-04; H01M008-06

AB WO 200066487 A UPAB: 20010220

NOVELTY - A hydrocarbon reformer system comprises first and second reactors and a heat exchanger. The first reactor is configured to **generate hydrogen**-rich reformate (1) by carrying out at least one of non-catalytic thermal partial oxidation, catalytic partial oxidation and/or steam reforming. The second reactor is in fluid communication with the first reactor to receive (1) and has a catalyst for promoting a water gas shift reaction into (1).

DETAILED DESCRIPTION - The heat exchanger has a first mass of two-phase water and is configured to exchange heat between the two-phase water and (1) in the second reactor. The heat exchanger is in fluid communication with the first reactor so as to supply steam as a reactant to the first reactor. The ratio of the mass of catalyst to the first mass of the two-phase water is greater than 1.
INDEPENDENT CLAIMS are also included for:

(A) a method (M1) of controlling a hydrocarbon reformer during dynamic load operation;

(B) a method of operating the hydrocarbon reformer;

(C) a high efficiency system (I) for reforming the hydrocarbon fuel to generate (1) for use in an associated **fuel cells**;

(D) an auxiliary reactor (2) comprising a first burner for burning a first fuel and creating a heated gas stream and a first heat exchanger for transferring the heat from the gas stream and a heat transfer medium to the reformer reaction zone for additional heat exchange;

(E) a preferential oxidation reactor (3) comprising a first zone with an inlet for directing (1) stream into the zone; a second zone adjacent to the first zone; a catalyst within the second zone; and several flow paths for directing flow of (1) stream in diverging directions from the first zone and into the second zone, with the flow paths of the reformate stream continue in the same diverging directions through the second zone;

(F) a system comprising a first (3) and a condenser, with hydrogen also oxidized to produce water, and the water condenser down-line of the first (3) for receiving (1) stream containing water and condensing and recovering the water from the (1) stream;

(G) a method (M2) for preferentially oxidizing CO to CO2, comprising introducing (1) stream containing CO into the first (3), oxidizing at least a portion of the CO to produce CO2, and condensing water from (1) stream;

(H) an apparatus comprising a catalyst bed for oxidizing CO to CO2, inlet for introducing the reformate stream into the catalyst bed, and a cooler for cooling the reformate in the catalyst bed;

(I) a heat exchange system comprising a shift catalyst bed within a shift reaction vessel; and a preferentially oxidation catalyst within a preferential oxidation vessel, where the shift catalyst bed contains a cooler for cooling reaction stream flowing through the bed, the oxidizing catalyst bed is sequentially coupled to the shift reaction vessel, and the shift catalyst bed cooler is in fluid communication with the cooler of the oxidizing catalyst bed to allow a single coolant fluid to circulate in both the beds;

(J) a method (M3) for operating (3), comprising providing hydrogen reformate to a reactor, determining the amount of CO in the stream, adding oxygen to the stream to produce a desired ratio of oxygen to CO, flowing the mixture through (3), and adjusting the amount of oxygen containing gas which is added to the stream based upon CO concentration fluctuation;

(K) an apparatus for operating (3), comprising an inlet for supplying hydrogen containing CO-rich reformate to the reactor, a detector for determining the amount of CO in the stream, a conduit for adding oxygen to the stream, an outlet for flowing the mixture through (3), and a controller for adjusting the amount of oxygen containing gas;

(L) a reactor system comprising a reformate source, a first catalyst bed and a second catalyst bed, each having a catalyst, and a first manifold connecting both the catalyst beds to the reformate source, where the manifold has a flow director for directing a flow of the reformate through one or the other of the first and/or second beds in the case of an increase in reformate source flow so as to accommodate the added flow;

(M) a shift reactor for subjecting CO and water to a water-gas shift reaction comprising a shift reactor vessel including a first shift reaction zone, and a first helical tube disposed within the

first shift reaction zone, where the first shift reaction zone has an input side for receiving reformate constituents including CO and an outlet side for discharging shift reacted constituents including CO2 and hydrogen gas, and the first helical tube has an inlet end which communicates with an oxygen containing gas supply source and an outlet end communicating with a fuel processing vessel;

(N) a hydrocarbon fuel reformer;

(O) a fuel processor;

(P) a reactor (R1) comprising a reaction vessel, a first shift reactor zone contains a first shift catalyst, and a boiler tube carrying the heat transfer medium and permitting a heat transfer between a first portion of the tube and reaction constituents in the first shift zone.

USE - For **producing hydrogen**-rich reformate gas for use in an associated **fuel cell**(claimed). Also used in portable power units, transportation and small power plant (e.g. household backup or primary power systems).

ADVANTAGE - The process utilizes the waste reformate to assist in the preheating of unreformed fuel before its entry into the reforming chamber and simultaneously converts the harmful constituents of the waste reformate into acceptable emissions.

Dwg.0/18

TECH WO 200066487 A1UPTX: 20010220

TECHNOLOGY FOCUS - CHEMICAL ENGINEERING - Claimed Method of Controlling Hydrocarbon Reformer: Method (M1) of controlling a hydrocarbon reformer during dynamic load operation comprises:

(i) supplying a hydrocarbon fuel to the first reactor which generates (1);

(ii) generating steam under pressure in a loop which includes a steam generator and a water/steam separator;

(iii) supplying the steam at a first rate to the reactor;

(iv) maintaining a stable steam pressure in the loop at the first rate of supplying steam and the hydrocarbon fuel;

(v) in response to a change in demand for (1) from the generator, changing the rate of supply of the hydrocarbon fuel and the steam to second supply rates respectively;

(vi) permitting a change in the pressure of the loop within an acceptable range for a time in response to the second supply rate; and

(vii) generating steam to return the loop pressure to the desired pressure.

Claimed Method of Operating Hydrocarbon Reformer: Method of operating the hydrocarbon reformer comprises: providing a first mass of catalyst in the first reactor zone for promoting water gas shift reaction in (1); generating steam in an auxiliary reactor (2); and transferring heat from the steam to the first mass of a catalyst:

Claimed System for Reforming Hydrocarbon Fuel: A high efficiency system (I) for reforming the hydrocarbon fuel to generate (1) for

use in an associated **fuel cells** comprising a gas generator, at least one shift reaction zone, a preferential oxidation reactor (3), (2), and a heat exchange system. The gas generator has at least one **endothermic** reaction zone in thermal contact with at least one **exothermic** reaction zone. (2) oxidizes reformate components which are not consumed by the associated **fuel cell**, and minimizes exhaust but maximizes the extraction of thermal energy. The heat exchange system circulates at least one of fuel, air, water and/or steam through the heat exchanger in the gas generator, the shift reaction zone, (3) and (2) to utilize the thermal energy generated by the reforming reaction to volatilize the input components and the heat catalyst.

Claimed Hydrocarbon Fuel Reformer: A hydrocarbon fuel reformer comprises a first reaction vessel, a shift reactor vessel and a first helical tube. The shift reactor vessel is annularly disposed about the first reaction vessel and includes a first shift reactor zone. The first helical tube is disposed within the first shift reactor zone and has an inlet end which communicates with a water supply source.

Claimed Fuel Processor: A fuel processor comprising a vessel having a first end, a second end, and an outer wall; a partial oxidation zone disposed in the vessel; and a steam reforming zone. The partial oxidation zone extends between the first and the second ends and is bound by a first inner wall. The steam reforming zone is interposed between the first inner wall and the outer wall. The first inner wall has a port which is disposed near the first end to define a first transition between a first flow path of reactants through the partial oxidation zone and a second flow path of reactants through the steam reforming zone in a direction opposite the first flow path.

Preferred Systems: (10) includes (2) which is configured to generate either heated water/steam or steam and is in fluid communication with the heat exchanger of the second reactor or the first reactor to supply the heated water/steam or steam to the heat exchanger or the first reactor respectively.

(10) includes a steam separator which is interposed between (2) and the heat exchanger and in communication with both heat exchanger and (2). The steam separator has a second mass of water/steam.

The ratio of the catalyst to the first and second mass of water is greater than 1.

The ratio of the first mass of two-phase water to catalyst is greater than 3 (preferably greater than 5).

The water/steam mixture in the high efficiency system is circulated as a two-phase mixture in a first section of circulation through the heat exchange system.

The two-phase mixture absorbs heat and actively cools the temperature of at least one of (3) and a shift reaction zone and

```
     optionally of (2).
     (I) further comprises a water/steam separator for separating the
     water from the steam.
     The steam is passed into heat exchangers in at least one of a high
     temperature shift reaction zone and a gas generator comprising at
     least one of a partial oxidation (POx) reactor and a steam reformer
     or an autothermal reactor having a partial oxidation (POx) zone and
     a steam reforming zone.
ABEX WO 200066487 A1UPTX: 20010220
     EXAMPLE - None given.
KW   [1]  255-0-0-0 CL PRD; 783-0-0-0 CL PRD; 97153-0-0-0 CL PRD;
     7382-0-0-0 CL
FS   CPI EPI
FA   AB; DCN
MC   CPI: E11-Q01; E31-A01; E31-A02; E31-N05C; H04-E04; H04-F02E;
          J04-E02; L03-E04
     EPI: X16-C17
DRN  0323-S; 0323-U; 1066-P; 1066-U; 1423-P; 1423-U; 1532-P; 1532-U
CMC  UPB   20010220
     M3   *01* C106 C108 C530 C730 C800 C801 C802 C803 C805 C807 M411 M424
               M720 M740 M904 M905 M910 N209 N224 N411 N441 N515 Q417 Q454
               DCN: R01066-K; R01066-P
     M3   *02* C106 C108 C550 C730 C800 C801 C802 C803 C805 C807 M411 M424
               M720 M740 M904 M905 M910 N209 N224 N441 N515 Q417 Q454
               DCN: R01423-K; R01423-P
     M3   *03* C101 C550 C810 M411 M424 M720 M740 M904 M905 N209 N224 N441
               N515 Q417 Q454
               DCN: R01532-K; R01532-P
     M3   *04* M210 M211 M320 M416 M610 M620 M730 M904 M905 M910
               DCN: R00323-K; R00323-S


L79  ANSWER 10 OF 14  WPIX  COPYRIGHT 2005 THE THOMSON CORP on STN
AN   1997-551385 [51]   WPIX
DNN  N1997-459401       DNC C1997-176075
TI   Hydrogen free of carbon mon oxide and carbon di oxide - is generated
     from methanol in a membrane reactor, is suitable for direct use on
     the anode side of a PEM fuel cell.
DC   E36 L03 X16
IN   DE HAART, L G J; MEUSINGER, J; STIMMING, U; DE HAART, L G; HAART, L
PA   (KERJ) FORSCHUNGSZENTRUM JUELICH GMBH
CYC  21
PI   DE 19618816     A1 19971113 (199751)*       3    C01B003-32     <--
     WO 9743796      A1 19971120 (199801)  GE   15    H01M008-06     <--
        RW: AT BE CH DE DK ES FI FR GB GR IE IT LU MC NL PT SE
         W: AU CA JP US
     AU 9729496      A  19971205 (199814)             H01M008-06     <--
     DE 19618816     C2 19990826 (199938)             C01B003-32     <--
```

JP 2000510433 W 20000815 (200044) 10 C01B003-32 <--
US 6129861 A 20001010 (200052) C06D001-02 <--

ADT DE 19618816 A1 DE 1996-1018816 19960510; WO 9743796 A1 WO 1997-DE880 19970426; AU 9729496 A AU 1997-29496 19970426; DE 19618816 C2 DE 1996-1018816 19960510; JP 2000510433 W JP 1997-540374 19970426, WO 1997-DE880 19970426; US 6129861 A Cont of WO 1997-DE880 19970426, US 1998-185228 19981103

FDT AU 9729496 A Based on WO 9743796; JP 2000510433 W Based on WO 9743796

PRAI **DE 1996-19618816 19960510**

IC ICM C01B003-32; C06D001-02; H01M008-06
ICS B01J004-04; B01J007-00; B01J008-08; C01B003-26; C01B003-56

AB DE 19618816 A UPAB: 19971222
A reactor for **generating H2** free of CO or CO2 from CH3OH has a membrane (1) that partitions the reactor into two chambers (3,4) and filters out CO2 from a mixture of H2,CO and CO2 produced in the 1st chamber (3) using a catalyst CO is converted into CH4 in the 2nd chamber (4). Also claimed is a process for converting CH3OH into H2 by converting it first into a mixture of CO, CO2 and H2 and then removing the CO2 from the gas mixture before converting the CO into CH4.

USE - To **produce H2** that can be used directly as a fuel on the anode side of a PEM **fuel cell**.

ADVANTAGE - The CO content of the H2 can be reduced as low as 10 ppm making it suitable for direct PEM **fuel cell** use. The membrane separates the site of a strongly **exothermic** reaction from that of a strongly **endothermic** reaction thereby avoiding undesirable temperature rises in the methanisation catalyst.
Dwg.1/1

FS CPI EPI

FA AB; GI; DCN

MC CPI: E31-A02; L03-E04B
EPI: X16-C01C; X16-E06A

DRN 0270-S; 1532-P

CMC UPB 19980202
M3 *01* C101 C550 C810 M411 M424 M720 M740 M903 M904 M910 N104 N120 Q454
DCN: R01532-P

L79 ANSWER 11 OF 14 WPIX COPYRIGHT 2005 THE THOMSON CORP on STN

AN 1997-473535 [44] WPIX

DNN N1997-394828 DNC C1997-150593

TI Reforming of hydrocarbon fuel gas to hydrogen-containing gaseous fuel - uses **exothermic** oxidation reaction of methanol as raw fuel and **endothermic** reforming reaction of raw fuel

using heat generated by the **exothermic** reaction.

DC E36 H04 J04 L03 T01 X16
IN NEGISHI, Y
PA (TOYT) TOYOTA JIDOSHA KK
CYC 6

PI	EP 798798	A2	19971001	(199744)*	EN	40	H01M008-06	<--
	R: DE FR GB							
	JP 09315801	A	19971209	(199808)		28	C01B003-38	<--
	CA 2198333	A	19970926	(199816)			C01B003-34	<--
	US 6165633	A	20001226	(200103)			H01M008-06	<--
	CA 2198333	C	20010807	(200148)	EN		C01B003-34	<--
	EP 798798	B1	20030730	(200356)	EN		H01M008-06	
	R: DE FR GB							
	DE 69723753	E	20030904	(200366)			H01M008-06	

ADT EP 798798 A2 EP 1997-102595 19970218; JP 09315801 A JP 1996-331455 19961126; CA 2198333 A CA 1997-2198333 19970224; US 6165633 A US 1997-800377 19970214; CA 2198333 C CA 1997-2198333 19970224; EP 798798 B1 EP 1997-102595 19970218, Related to EP 2002-24470 19970218; DE 69723753 E DE 1997-623753 19970218, EP 1997-102595 19970218
FDT DE 69723753 E Based on EP 798798
PRAI **JP 1996-331455 19961126; JP 1996-97469 19960326**
IC ICM C01B003-34; C01B003-38; H01M008-06
ICS B01J008-02; B01J008-04; B01J023-44; B01J023-80; C01B003-32; C01B003-36; H01M008-22
AB EP 798798 A UPAB: 19971113
Method for reforming a hydrocarbon supplied as fuel gas to **generate hydrogen**-containing gaseous fuel through a reforming reaction occurring in a predetermined reformed, comprises: (a) feeding a supply of oxygen to a raw fuel gas containing the raw fuel and enabling an **exothermic** oxidation reaction to proceed for a specified component of the raw fuel gas and (b) enabling an **endothermic** reforming reaction of the raw fuel to proceed with heat generated by the **exothermic** oxidation reaction of the specified component.
Also claimed are: (i) apparatus for reforming a hydrocarbon supplied as raw fuel to **generate** a **hydrogen**-containing gaseous fuel through a reforming reaction comprising: (a) a reformer unit which comprises a first catalyst for accelerating an **exothermic** oxidation reaction of the specified component and a second catalyst for accelerating an **endothermic** reforming reaction with heat generated by the oxidation reaction, (b) raw fuel supply unit for feeding a supply of raw fuel gas to the reformed unit and (c) oxygen supply unit for feeding oxygen to the raw fuel gas; and (ii) a **fuel cell** system comprises **fuel**-reforming apparatus and a **fuel cell** for receiving a supply of gaseous fuel from the

reforming apparatus and generating electrical energy.
USE - For reforming hydrocarbon supplied as fuel gas to **generate hydrogen**-containing gaseous fuel.
ADVANTAGE - The heat required for the **endothermic** reforming reaction is supplied by the oxidation of the raw fuel which is preferably methanol. No external heat source is required. Gaseous fuel with low content of carbon monoxide is obtained. Reformed raw fuel gas is obtained without lowering the energy efficiency of the whole **fuel cell** system.
Dwg.0/20

FS CPI EPI
FA AB; DCN
MC CPI: E31-A02; H04-C02; J04-E02; L03-E04
EPI: T01-F06; T01-J08A; X16-C17
DRN 0270-S; 1532-P; 1779-S
CMC UPB 19971211
M3 *01* C101 C550 C810 M411 M424 M720 M740 M903 M904 M910 N411 N441
N513 N514 N515 Q413 Q454
DCN: R01532-P

L79 ANSWER 12 OF 14 WPIX
AN 1991-290347 [40] WPIX
CR 1991-290348 [40]
DNN N1991-222319 DNC C1991-125505
TI Electrical generating plant esp. for submarine - comprises hydrogen-oxygen **fuel cell** using hydrogen peroxide and liq. hydrogen-contg. cpd. gas sources.
DC L03 Q24 W06 X16
IN ADAMS, V W; CATCHPOLE, J P; SEYMOUR, C M; WRIGHT, B J
PA (VICS) VICKERS SHIPBUILDING & ENG; (VICS) VICKERS SHIPBLDG EN
CYC 6

PI	GB 2242562	A	19911002	(199140)*			<--
	NL 8515001	A	19911101	(199147)			<--
	DE 3537526	A	19920123	(199205)			<--
	FR 2664746	A	19920117	(199213)	34		<--
	GB 2242562	B	19920325	(199213)			<--
	DE 3537527	A	19920604	(199224)	15	H01M008-22	<--
	US 5141823	A	19920825	(199237)	13	H01M008-18	<--
	CA 1311264	C	19921208	(199303)		H01M008-06	<--
	DE 3537527	C2	19961002	(199644)	16	H01M008-22	<--

ADT GB 2242562 A GB 1985-3589 19850212; DE 3537526 A DE 1985-3537526 19850228; FR 2664746 A FR 1985-15411 19851016; GB 2242562 B GB 1985-3589 19850212; DE 3537527 A DE 1985-3537527 19850228; US 5141823 A US 1985-734705 19850304; CA 1311264 C CA 1985-476159 19850311; DE 3537527 C2 DE 1985-3537527 19850228
PRAI **GB 1984-5754 19840305; GB 1985-3589 19850212; GB 1985-3592 19850212**

IC ICM H01M008-06; H01M008-18; H01M008-22
ICS B63G008-08; C01B003-32; C01B013-02

AB GB 2242562 A UPAB: 19961111
Electrical **generating** plant comprises **H2**/O2 **fuel cell**; a liq cpd. **endothermic** reaction H2 source. liq H2O3 supply; a reformer for liberating H2 gas from the source; a decomposer for providing O2 from the H2O2; a heat supply for the reformer; and means for supplying the H2 and O2 to the cell.

The heat supply system includes a heat-exchanger arranged upstream of the reformer so as to impart up to 80% of the required heat to the cpd before it reaches the reformer. The remaining heat is supplied to the reformer, pref. via an electrical heater. The heat for the heat-exchanger is (partly) supplied by the **exothermic** reaction in the decomposer.

USE/ADVANTAGE- Esp. in a submarine. System provides optimum weight, space and chemical efficiency. @(26pp Dwg.No. 1/4)@

ABEQ GB 2242562 B UPAB: 19930928
An electrical generating plant comprising: a **fuel cell** which requires supplies of gaseous hydrogen and gaseous oxygen to generate an electrical output; first supply means for supplying to the plant a hydrogen-containing compound which is liquid at NTP and which can undergo an **endothermic** reaction to liberate gaseous hydrogen; second supply means for supplying to the plant liquid hydrogen peroxide; a reformer, connected to the first supply means, in which said hydrogen-containing compound can undergo said **endothermic** reaction and liberate gaseous hydrogen; a decomposer connected to the second supply means and arranged to decompose the hydrogen peroxide so as to liberate gaseous oxygen; means for supplying heat to the hydrogen-containing compound so as to maintain the **endothermic** reaction in the reformer; and means for supplying the gaseous hydrogen and the gaseous oxygen, given-off in the reformer and the decomposer respectively, to the **fuel cell** in order to generate an electrical output.
0/0

ABEQ US 5141823 A UPAB: 19930928
Electrial generating plant comprises (a) **fuel cell** requiring supply of gaseous hydrogen and oxygen; (b) first supply device to supply, to the plant, H2 contg. cpd. which is liq. at NTP; (c) second supply device selectively operable, to supply liq. H2O2 and then air; (d) reformer connected to frist supply device, in which H2 contg. cpd. liberates gaseous H2. Appts. also comprises (e) decomposer selectively connected to second supply device, to decomposte H2O2 **exothermically**, to liberate O2; (f) means to transmit given off heat to the H2 contg. cpd.; (g) means to supply heat to H2 contg. cpd.; (h) means to supply gaseous H2 to **fuel cell**; and (i) means to suppy gaseous oxygen

and air to **fuel cell** in second mode of
operation.
USE/ADVANTAGE - For obtaining electrical output. Used esp. in a submarine. Plant operates thermally self sufficiently.
1/6
FS CPI EPI GMPI
FA AB; GI
MC CPI: L03-E04; L03-H05
EPI: W06-B01C; X16-C

L79 ANSWER 13 OF 14 WPIX COPYRIGHT 2005 THE THOMSON CORP on STN
AN 1986-083729 [13] WPIX
CR 1992-049503 [07]
DNN N1986-061207 DNC C1986-035669
TI New **hydrogen generator** - useful esp. for high altitude inflation of rocket launched balloons.
DC E36 J06 P41 Q25 Q69 X16
IN ROSS, D P; STEINMAYER, A G
PA (BRIN-I) BRINK D L; (GENE) GENERAL ELECTRIC CO
CYC 6

PI	GB 2164637	A	19860326	(198613)*	8	<--
	DE 3533477	A	19860417	(198617)		<--
	FR 2570689	A	19860328	(198619)		<--
	JP 61111901	A	19860530	(198628)		<--
	IT 1190388	B	19880216	(199049)		<--
	AU 9186781	A	19911212	(199206)#		<--

ADT GB 2164637 A GB 1985-21478 19850829; FR 2570689 A FR 1985-13679 19850916; JP 61111901 A JP 1985-206762 19850920
PRAI **US 1984-653068 19840921**
IC B02C018-12; B64B001-58; C01B003-02; C01B006-00; D21B001-14; F17C011-00; G01W001-08
AB GB 2164637 A UPAB: 19940428
Generator (10) has a containment shell (12) with a **H2 prod.** gas outlet (14); shell (12) contains a solid matrix (16) of an **endothermically** decomposable metallic **hydride** shaped to fill the shell. Matrix (16) has a predetermined % of voids to effect controlled H2 release on **hydride** decomposition and also has holes (20) with chemical heating sources (24) therein to provide **exothermic** energy for the decomposition. Sources (24) each have an igniter (28) connected to an actuator (32) disposed on the shell (12).
Pref. shell (12) is spherical and the **hydride** is magnesium **hydride** catalysed by addn. of 5-10 wt.% Ni. Pref. the % of voids is 20-25% of the matrix vol and the heating sources (24) are TiB2 or Be and Mg (ClO4)2; sources (24) are pref. clad with ceramic tubes. Shell (12) may be stainless steel. Igniters (28) are pref. electrical squibs.
USE/ADVANTAGE - Generators have low wt., high volumetric

capacity, high rates of **H2 prodn.**, long
storage life and can fill balloons in 2-3 mins. They can be used as a power source to deliver high peak powers for short time periods and are useable in conjunction with e.g. **fuel cells** etc.
Dwg.1/1
FS CPI EPI GMPI
FA AB
MC CPI: E31-A02; J06-B06; N02-C01
EPI: X16-C
DRN 1532-P
CMC UPB 19930924
M3 *01* C101 C550 C810 M411 M424 M720 M740 M903 M910 Q431

L79 ANSWER 14 OF 14 WPIX COPYRIGHT 2005 THE THOMSON CORP on STN
AN 1970-01052R [01] WPIX
TI **Hydrogen generation** and direct use in molten.
DC E36 L03
PA (IGTE) INST GAS TECHNOLOGY
CYC 1
PI US 3488226 A (197001)*
PRAI **US 1965-506778 19651108**
IC H01N027-00
AB US 3488226 A UPAB: 19930831
Vaporized liquid hydrocarbon feedstock having an end boiling point up to 500 degrees F is **endothermically** reacted with steam in the presence of a nickel-aluminium catalyst at a pressure of 1-5 atm. and at 700-1100 degrees F. The obtained hydrogen-rich gas is supplied directly to a molten carbonate **fuel cell** anode to effect an electrochemical **exothermic** reaction producing electricity, heat and spent **fuel**. The **fuel cell** operates at a mean temperature above the reforming reaction temperature. The reforming reaction is maintained in heat exchange relationship with the **fuel cell**, whereby a portion of the **exothermic fuel cell** heat is used in the reforming reaction.
The overall efficiency of the **fuel cell** operation is increased.
FS CPI
FA AB
MC CPI: E31-A
CMC UPB 19930924
M3 *01* C810 C101 C550 N000 M720 M781 R010 M411 M901
M3 *02* C101 C550 C810 M210 M220 M225 M226 M231 M250 M261 M262 M263
M271 M272 M273 M280 M281 M282 M283 M311 M312 M313 M314 M315
M316 M320 M321 M322 M323 M332 M334 M340 M342 M343 M344 M349
M351 M352 M353 M361 M362 M363 M371 M372 M373 M381 M382 M383

M391 M392 M393 M411 M720 M781 M903 N000 R010 R011 R012 R013

=> file hca
FILE 'HCA'

=> d l35 1-19 cbib abs hitstr hitind

L35 ANSWER 1 OF 19 HCA COPYRIGHT 2005 ACS on STN
141:108959 **Fuel cell** system achieving high thermal-energy-utilization efficiency. Numao, Yasuhiro; Iwasaki, Yasukazu (Nissan Motor Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2004206950 A2 20040722, 22 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2002-372659 20021224.

AB The system comprises two kinds of **hydrogen-storing** systems, constituted by first one undergoing **exothermic** reaction in generating oxygen, and second one undergoing **endothermic** reaction in generating oxygen. The first one may be metal **hydrides** undergoing hydrolysis, while the second one may be hydrogen-absorbing materials (e.g., alloys, carbon nanotubes) undergoing desorption. In start-up of the **fuel cell** system, undesired thermal energy consumption for **generating hydrogen** can be saved.

IT **1333-74-0P**, **Hydrogen**, uses
(**generation**; **fuel cell** system capable of selecting either or both **exothermic**- or **endothermic hydrogen generation**)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H— H

IC ICM H01M008-04
ICS H01M008-00

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** hydrogen supply combination **endothermic exothermic** reaction; thermal energy saving **fuel cell** hydrogen supply

IT Alloys, uses
(contg. absorbed hydrogen, undergoing **endothermic** reaction in **generating hydrogen**; **fuel cell** system capable of selecting either or both

exothermic- or **endothermic hydrogen generation**)

IT **Fuel cells**
(**fuel cell** system capable of selecting either or both **exothermic**- or **endothermic hydrogen generation**)

IT **Hydrides**
(undergoing **exothermic** reaction in **generating hydrogen**; **fuel cell** system capable of selecting either or both **exothermic**- or **endothermic hydrogen generation**)

IT **1333-74-0P, Hydrogen**, uses
(**generation**; **fuel cell** system capable of selecting either or both **exothermic**- or **endothermic hydrogen generation**)

L35 ANSWER 2 OF 19 HCA COPYRIGHT 2005 ACS on STN
141:57047 Fuel reformer and fuel reforming method and turbine power plant. Tsuji, Tadashi (Mitsubishi Heavy Industries, Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2004168620 A2 20040617, 18 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2002-338706 20021122.

AB The reformer has a solid oxide electrolyte membrane permeating O ions from an O contg. fluid and a catalyst **generating** CO and **H** by reacting the permeated O ions with a hydrocarbon fuel. The method is carried out by executing a combination of an **exothermic** reaction and an **endothermic** reaction between the permeated O ions and the hydrocarbon fuel by the catalyst to generate the CO and the H. The power plant has a compressor for compressing air, a combustion facility supplied by the compressed air, CO and H, a gas turbine expanded by the combustion gas of the combustion facility, and an exhaust heat recovery boiler heat recovering the exhaust gas of the gas turbine; where the power plant has the above reformer arranged at a gas turbine exhaust gas passage of the boiler inlet side; and the combustion facility supplied by the CO and the **H** which are **generated** by the reformer.

IC ICM C01B003-38
ICS F01D015-08; F01K023-10; F02C003-22; F02C006-00; F02C006-18; F02C007-22; F02G005-02; G21D009-00; H01M008-06

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

IT **Fuel cells**
(power plants; structure of fuel reformers and turbine power plants and methods of reforming fuel)

L35 ANSWER 3 OF 19 HCA COPYRIGHT 2005 ACS on STN
140:290053 Method and apparatus for reforming hydrocarbons into hydrogen, solid oxide **fuel cells** employing same process, and **fuel cell** power generation system.

Shimoyama, Tadashi; Yokota, Hiroshi (Ebara Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2004111181 A2 20040408, 10 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2002-271163 20020918.

AB Both hydrocarbons and O2(g) are supplied to solid oxide **fuel cells** for performing both **endothermic** reforming of the hydrocarbons into hydrogen by partial oxidn., and **exothermic** oxidn. of the resultant **hydrogen** for power **generation.** In **fuel cell** power generation system employing the process above claimed, unreacted hydrogen is returned to the reforming app. again. The process and system show improved heat efficiency in the reforming.

IT **7440-06-4**, Platinum, uses
(**fuel cell fuel** electrodes; **exothermic** reforming of hydrocarbons into hydrogen with **endothermic** oxidn. of hydrogen for solid oxide **fuel cell** operation)

RN 7440-06-4 HCA

CN Platinum (8CI, 9CI) (CA INDEX NAME)

Pt

IC ICM H01M008-06
ICS C01B003-38; C01B003-48; H01M004-86; H01M008-00; H01M008-02; H01M008-10; H01M008-12

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST solid oxide **fuel cell** hydrocarbon reforming **manuf hydrogen**; oxidn hydrogen **fuel cell** hydrocarbon reforming

IT **Fuel cell** anodes
Fuel cells
(**exothermic** reforming of hydrocarbons into hydrogen with **endothermic** oxidn. of hydrogen for solid oxide **fuel cell** operation)

IT Oxidation
(of hydrogen; **exothermic** reforming of hydrocarbons into hydrogen with **endothermic** oxidn. of hydrogen for solid oxide **fuel cell** operation)

IT Synthesis gas manufacturing
(partial oxidn.; **exothermic** reforming of hydrocarbons into hydrogen with **endothermic** oxidn. of hydrogen for solid oxide **fuel cell** operation)

IT Hydrocarbons, processes
(partial oxidn.; **exothermic** reforming of hydrocarbons into hydrogen with **endothermic** oxidn. of hydrogen for solid oxide **fuel cell** operation)

IT **Fuel cells**
(power plants; **exothermic** reforming of hydrocarbons

into hydrogen with **endothermic** oxidn. of hydrogen for solid oxide **fuel cell** operation)

IT 630-08-0, Carbon monoxide, processes
(**exothermic** reforming of hydrocarbons into hydrogen with **endothermic** oxidn. of hydrogen for solid oxide **fuel cell** operation)

IT 74-82-8, Methane, uses 1333-74-0, Hydrogen, uses
(**exothermic** reforming of hydrocarbons into hydrogen with **endothermic** oxidn. of hydrogen for solid oxide **fuel cell** operation)

IT 7440-02-0, Nickel, uses **7440-06-4**, Platinum, uses
(**fuel cell fuel** electrodes;
exothermic reforming of hydrocarbons into hydrogen with **endothermic** oxidn. of hydrogen for solid oxide **fuel cell** operation)

L35 ANSWER 4 OF 19 HCA COPYRIGHT 2005 ACS on STN

139:200013 Thermally efficient **hydrogen storage** system. Gelsey, Jon (USA). U.S. Pat. Appl. Publ. US 2003162059 A1 20030828, 8 pp. (English). CODEN: USXXCO. APPLICATION: US 2002-86904 20020228.

AB The present disclosure concerns methods and app. comprising both **exothermic** and **endothermic hydrogen generators**. In certain embodiments of the invention, such **hydrogen generators** may be used to provide hydrogen fuel to a **fuel cell**. The use of both **exothermic** and **endothermic hydrogen generators** is advantageous for providing thermally efficient **hydrogen storage** systems that reduce or eliminate the formation of waste heat resulting from **hydrogen generation**. In some embodiments of the invention, the **exothermic hydrogen generator** comprises a sodium **borohydride hydrogen generator** and the **endothermic hydrogen generator** comprises a metal **hydride** storage system. In various embodiments of the invention, the rates of **exothermic** and/or **endothermic hydrogen generation** may be controlled. Control of **exothermic** and/or **endothermic hydrogen generation** may provide **endothermic** or thermally neutral **hydrogen prodn**. In certain embodiments of the invention, the thermally efficient **hydrogen storage** system may be used to provide elec. power to a portable electronic device.

IT **7440-44-0**, Carbon, uses
(nanotubes; thermally efficient **hydrogen storage** system)

RN 7440-44-0 HCA

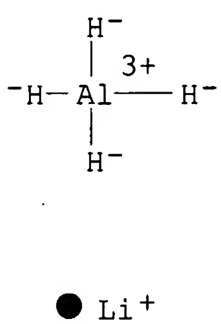
CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

IT **7440-06-4**, Platinum, uses
(thermally efficient **hydrogen storage** system)
RN 7440-06-4 HCA
CN Platinum (8CI, 9CI) (CA INDEX NAME)

Pt

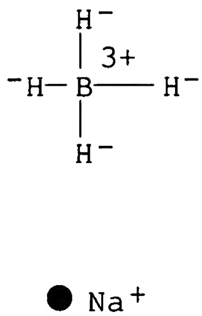
IT **16853-85-3**, Aluminum lithium **tetrahydride**
(thermally efficient **hydrogen storage** system)
RN 16853-85-3 HCA
CN Aluminate(1-), tetrahydro-, lithium, (T-4)- (9CI) (CA INDEX NAME)



IT **1333-74-0P**, Hydrogen, uses
(thermally efficient **hydrogen storage** system)
RN 1333-74-0 HCA
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

IT **16940-66-2P**, Sodium **borohydride**
(thermally efficient **hydrogen storage** system)
RN 16940-66-2 HCA
CN Borate(1-), tetrahydro-, sodium (8CI, 9CI) (CA INDEX NAME)



IT 7429-90-5, Aluminum, uses 7440-50-8, Copper, uses
(thermally efficient **hydrogen storage** system)
RN 7429-90-5 HCA
CN Aluminum (8CI, 9CI) (CA INDEX NAME)

Al

RN 7440-50-8 HCA
CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IC ICM H01M008-06
ICS C01B003-02
INCL 429017000; 429020000; 423648100
CC 52-3 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 49
ST **hydrogen storage** system thermally efficient;
fuel cell hydrogen storage
system thermally efficient
IT Nanotubes
(carbon; thermally efficient **hydrogen storage**
system)
IT Electric apparatus
(**fuel cell**-coupled; thermally efficient
hydrogen storage system)
IT Alloys, uses
(**hydrides**; thermally efficient **hydrogen**
storage system)
IT Oxidation
(partial; thermally efficient **hydrogen storage**
system)
IT Fuel gas manufacturing

(reforming; thermally efficient **hydrogen storage** system)

IT Reforming apparatus
(steam, hydrocarbon; thermally efficient **hydrogen storage** system)

IT Catalysts
Containers
Fuel cells
Heat transfer
Storage
(thermally efficient **hydrogen storage** system)

IT Hydrocarbons, processes
(thermally efficient **hydrogen storage** system)

IT **Hydrides**
(thermally efficient **hydrogen storage** system)

IT **7440-44-0**, Carbon, uses
(nanotubes; thermally efficient **hydrogen storage** system)

IT **7440-06-4**, Platinum, uses
(thermally efficient **hydrogen storage** system)

IT **16853-85-3**, Aluminum lithium **tetrahydride**
16971-29-2, **Borohydride**
(thermally efficient **hydrogen storage** system)

IT **1333-74-0P**, Hydrogen, uses
(thermally efficient **hydrogen storage** system)

IT **16940-66-2P**, Sodium **borohydride**
(thermally efficient **hydrogen storage** system)

IT **7429-90-5**, Aluminum, uses **7440-50-8**, Copper, uses
(thermally efficient **hydrogen storage** system)

L35 ANSWER 5 OF 19 HCA COPYRIGHT 2005 ACS on STN

138:371689 **Fuel cell** power plant and its operation.
Komatsu, Takeshi; Takeshi, Tetsuo (Nippon Telegraph and Telephone Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2003132919 A2 20030509, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-327427 20011025.

AB The power plant has a fuel treating means **generating** a **H** rich fuel gas from a raw **fuel**; a **fuel cell** supplied by the fuel gas and an oxidant gas for power generation; an **endothermic** reaction means chem. storing waste heat from the **fuel cell** by an **endothermic** reaction of a 1st compd. converting a 2nd compd., an **exothermic** reaction means releasing the stored heat by **exothermic** reaction of the 2nd compd. converting to the 1st compd., and a heat transfer means supplying the released heat to the fuel treating means and/or the **fuel cell**. The power plant is operated by storing the exhaust heat during power generation by the **endothermic** reaction;

releasing the stored heat by the **exothermic** reaction after stopping the power plant; supplying the released heat to the fuel treating means and/or the **fuel cell**; and storing the generated 1st compd. by the **exothermic** reaction for the **endothermic** reaction.

IC ICM H01M008-04
ICS H01M008-10

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** power plant structure operation

IT **Fuel cells**
(power plants; structure and operation of **fuel cell** power plant contg. **endothermic** and **exothermic** reaction means for storing and releasing cell waste heat)

L35 ANSWER 6 OF 19 HCA COPYRIGHT 2005 ACS on STN

137:386872 Natural gas processing technologies for large scale solid oxide **fuel cells**. Wang, Robin; Rohr, Donald (General Electric Company, Des Plaines, IL, 60017, USA). Preprints of Symposia - American Chemical Society, Division of Fuel Chemistry, 47(2), 506-507 (English) **2002**. CODEN: PSADFZ. ISSN: 1521-4648. Publisher: American Chemical Society, Division of Fuel Chemistry.

AB A review of the various reforming technologies for converting natural gas to **generate hydrogen** for solid oxide **fuel cells** (SOFC). The advantages and disadvantages of steam reforming, auto-thermal reforming, and catalytic partial oxidn. are outlined.

CC 52-0 (Electrochemical, Radiational, and Thermal Energy Technology)

ST review natural gas reforming processing solid oxide **fuel cell**

IT Heat balance
(consideration to balance **endothermic** and **exothermic** reactions; natural gas processing technol. for large scale solid oxide **fuel cells**)

IT Natural gas, processes
(natural gas processing technol. for large scale solid oxide **fuel cells**)

IT Synthesis gas manufacturing
(partial oxidn.; natural gas processing technol. for large scale solid oxide **fuel cells**)

IT Reaction kinetics
(process response to transient fluctuations in operating conditions; natural gas processing technol. for large scale solid oxide **fuel cells**)

IT Synthesis gas manufacturing
(reforming synthesis gas manufg.; natural gas processing technol. for large scale solid oxide **fuel cells**)

IT **Fuel cells**
(solid oxide; natural gas processing technol. for large scale solid oxide **fuel cells**)
IT Synthesis gas manufacturing
(steam reforming synthesis gas manufg.; natural gas processing technol. for large scale solid oxide **fuel cells**
)

L35 ANSWER 7 OF 19 HCA COPYRIGHT 2005 ACS on STN
136:281515 Steam reforming method for **producing hydrogen**-rich gas without supplying external heat. Kaneko, Tomoko; Yoshida, Noriko; Yamashita, Toshio; Kawasaki, Terufumi (Hitachi Ltd., Japan; Babcock-Hitachi K. K.). Jpn. Kokai Tokkyo Koho JP 2002104808 A2 **20020410**, 7 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2000-299102 20000927.
AB A source gas contg. O (or air), hydrocarbons, and steam is brought in contact with a catalyst for simultaneously accelerating the oxidn. reaction and steam-reforming reaction of the hydrocarbons. The catalyst comprises Pd, Pt, Ru, or Rh, optionally with Ni, Co, Fe, Ag, Cu, Zn, Cr, and/or rare earth metals supported on a porous carrier comprising Al-contg. oxide. In the catalyst, amts. of the active elements for accelerating the reactions are regulated for balancing the **exothermic** heat from the oxidn. reaction and the **endothermic** heat from the steam-reforming reaction, so that the temp. of the whole catalyst can be kept at a desired temp. without supplying heat from the exterior.
IT **7440-06-4**, Platinum, uses **7440-50-8**, Copper, uses
(steam reforming method for **producing H**-rich gas by using catalyst without supplying external heat)
RN 7440-06-4 HCA
CN Platinum (8CI, 9CI) (CA INDEX NAME)

Pt

RN 7440-50-8 HCA
CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IT **1333-74-0P, Hydrogen, preparation**
(steam reforming method for **producing H**-rich gas by using catalyst without supplying external heat)
RN 1333-74-0 HCA
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H— H

IC ICM C01B003-40
ICS B01J023-10; B01J032-00; C01B003-48; H01M008-06; H01M008-10
CC 49-1 (Industrial Inorganic Chemicals)
Section cross-reference(s): 52
ST steam reforming catalyst temp control **hydrogen**
prodn
IT **Fuel cells**
(solid electrolyte; steam reforming method for **producing**
H-rich gas by using catalyst without supplying external
heat)
IT Oxidation catalysts
Steam reforming
Steam reforming catalysts
(steam reforming method for **producing** **H**-rich
gas by using catalyst without supplying external heat)
IT Rare earth metals, uses
(steam reforming method for **producing** **H**-rich
gas by using catalyst without supplying external heat)
IT 1302-88-1, Cordierite 1302-93-8, Mullite 1344-28-1, Alumina,
uses 7439-91-0, Lanthanum, uses
(carrier; steam reforming method for **producing**
H-rich gas by using catalyst without supplying external
heat)
IT 7439-89-6, Iron, uses 7440-02-0, Nickel, uses 7440-05-3,
Palladium, uses **7440-06-4**, Platinum, uses 7440-16-6,
Rhodium, uses 7440-18-8, Ruthenium, uses 7440-22-4, Silver, uses
7440-47-3, Chromium, uses 7440-48-4, Cobalt, uses
7440-50-8, Copper, uses 7440-66-6, Zinc, uses
(steam reforming method for **producing** **H**-rich
gas by using catalyst without supplying external heat)
IT 74-82-8, Methane, processes
(steam reforming method for **producing** **H**-rich
gas by using catalyst without supplying external heat)
IT **1333-74-0P**, **Hydrogen**, **preparation**
(steam reforming method for **producing** **H**-rich
gas by using catalyst without supplying external heat)

136:88225 Thermal supply system in power plant with energy conversion.
Murata, Keiji; Watanabe, Hiroshi; Hisa, Shoichi; Izuru, Kenji
(Toshiba Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2002004812 A2
20020109, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION:
JP 2000-192813 20000627.
AB The system includes a power plant to generate thermal energy,, an

endothermal reaction plant for recovering the thermal energy as chem. energy, an **exothermal** reaction plant for converting the chem. energy from the **endothermal** reaction plant to thermal energy, and a driving device (e.g., **fuel cell**) using **H2** gas **formed** in the **endothermal** reaction plant as energy source.

IT **7440-06-4**, Platinum, uses
(thermal supply system in power plant with energy conversion)
RN 7440-06-4 HCA
CN Platinum (8CI, 9CI) (CA INDEX NAME)

Pt

IC ICM F01K017-06
ICS F02B043-00; F02C003-28; F02C006-00; F02G005-04; F02M021-02; H01M008-00; H01M008-06
CC 51-23 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 52
ST thermal system power plant steam turbine **endothermal exothermal** reaction
IT **Exothermic** reaction
Fuel cells
Heat
Steam
(thermal supply system in power plant with energy conversion)
IT 7440-02-0, Nickel, uses **7440-06-4**, Platinum, uses
(thermal supply system in power plant with energy conversion)

L35 ANSWER 9 OF 19 HCA
135:373655 **Production** of **hydrogen** by autothermic decomposition of ammonia. Goetsch, Duane A.; Schmit, Steve J. (Gradient Technology, USA). PCT Int. Appl. WO 2001087770 A1 **20011122**, 26 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2001-US15285 20010510. PRIORITY: US 2000-PV203542 20000512.

AB The invention relates to the autothermic decompn. of NH3 to **produce** high-purity **H2**. A mixt. of NH3 and an O-contg. gas (e.g., air) is contacted with an NH3 decompn. catalyst to obtain H2 and N2 by an **endothermic** reaction. A portion of the resulting H2 is burned in the reaction zone by an

exothermic reaction that produces an effective amt. of heat to maintain the NH3 decompn. reaction. The invention also relates to a **fuel cell** system wherein **H2** that is **produced** from the autothermic decompn. of NH3 is used as a fuel.

IT **7440-06-4**, Platinum, uses
(catalyst for **prodn**. of **hydrogen** by autothermic decompn. of ammonia)

RN 7440-06-4 HCA

CN Platinum (8CI, 9CI) (CA INDEX NAME)

Pt

IT **1333-74-0P, Hydrogen, preparation**
(**prodn**. of **hydrogen** by autothermic decompn. of ammonia)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

IC ICM C01B003-04
ICS F02B043-08; H01M008-04; H01M008-18

CC 49-1 (Industrial Inorganic Chemicals)
Section cross-reference(s): 52

ST **hydrogen prodn** ammonia decompn **fuel cell**

IT **Fuel cells**
(**prodn**. of **hydrogen** by autothermic decompn. of ammonia for)

IT 7439-89-6, Iron, uses 7439-96-5, Manganese, uses 7440-02-0, Nickel, uses 7440-05-3, Palladium, uses **7440-06-4**, Platinum, uses 7440-18-8, Ruthenium, uses 7440-47-3, Chromium, uses 7440-48-4, Cobalt, uses
(catalyst for **prodn**. of **hydrogen** by autothermic decompn. of ammonia)

IT **1333-74-0P, Hydrogen, preparation**
(**prodn**. of **hydrogen** by autothermic decompn. of ammonia)

IT 7664-41-7, Ammonia, processes
(**prodn**. of **hydrogen** by autothermic decompn. of ammonia)

IT 1309-48-4, Magnesia, uses 1335-30-4, Aluminum silicate 1344-28-1, Alumina, uses 7631-86-9, Silica, uses 13463-67-7, Titania, uses 159995-97-8, Aluminum silicon oxide
(support form catalyst in **prodn**. of **hydrogen**

by autothermic decompn. of ammonia)

L35 ANSWER 10 OF 19 HCA COPYRIGHT 2005 ACS on STN
135:244876 Analysis of autothermal reformer for **H2 production** for proton exchange membrane **fuel cell** vehicles. Wang, Sheng-nian; Wang, Shu-dong; Wu, Di-yong; Hong, Xue-lun (Dalian Institute of Chemical Physics, Chinese Academy of Sciences, Dalian, 116023, Peop. Rep. China). Ranliao Huaxue Xuebao, 29(3), 238-242 (Chinese) **2001**. CODEN: RHXUD8. ISSN: 0253-2409. Publisher: Kexue Chubanshe.

AB The coupling of oxidn. of methanol (a strong **exothermic** process) with the steam reforming reaction(a high **endothermic** process) is an attractive route for **H2 prodn**. in terms of energy minimization. Anal. showed that the radial reactor is the most attractive configuration for on-board **H2 generation**. Using a one-dimensional homogeneous model, the paper discussed the performance of this self-evident process. The optimal rate of water to methanol and pressure are 2 (under normal pressure) or 3 (when P >1 atm) and 0.2MPa-0.3 MPa, resp.

IT **1333-74-0P, Hydrogen, preparation**
(anal. of autothermal reformer for **H2 prodn**. for proton exchange membrane **fuel cell** vehicles)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

CC 52-1 (Electrochemical, Radiational, and Thermal Energy Technology)

ST methanol **endothermal** steam reforming hydrogen **fuel cell**

IT Solid state **fuel cells**
(anal. of autothermal reformer for **H2 prodn**. for proton exchange membrane **fuel cell** vehicles)

IT Fuel gas manufacturing
(steam reforming; anal. of autothermal reformer for **H2 prodn**. for proton exchange membrane **fuel cell** vehicles)

IT 67-56-1, Methanol, uses
(anal. of autothermal reformer for **H2 prodn**. for proton exchange membrane **fuel cell** vehicles)

IT **1333-74-0P, Hydrogen, preparation**
(anal. of autothermal reformer for **H2 prodn**. for proton exchange membrane **fuel cell**

vehicles)

L35 ANSWER 11 OF 19 HCA COPYRIGHT 2005 ACS on STN
134:357927 Catalyst for **exothermic** or **endothermic** reaction, catalyst for water-gas-shift reaction and catalyst for selective oxidation of carbon monoxide, and plate-fin heat exchange type reformer. Shiizaki, Shinji; Nagashima, Ikuo; Terada, Seiji; Sakai, Noriyuki (Kawasaki Jukogyo Kabushiki Kaisha, Japan). PCT Int. Appl. WO 2001037988 A1 **20010531**, 72 pp. DESIGNATED STATES: W: CA, JP, US; RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR. (Japanese). CODEN: PIXXD2. APPLICATION: WO 2000-JP8234 20001122. PRIORITY: JP 1999-333918 19991125.

AB Claimed are a catalyst for an **exothermic** reaction such as burning or an **endothermic** reaction such as steam reforming and a method for prepg. the catalyst; a catalyst for a water-gas-shift reaction or a selective oxidn. of carbon monoxide and a method for prepg. the catalyst; and a plate-fin heat exchange type reformer. A method for prepg. a catalyst is claimed, wherein a metal or a metal oxide having a catalytic activity is homogeneously carried in a high degree of dispersion, which comprises forming a porous oxide film on a metal substrate, immersing the resultant substrate in an aq. soln. of a metal compd. being a weak electrolyte having a small degree of dissocn. or in an org. solvent soln. of a metal compd., and then firing the resulting product. A plate-fin heat exchange type reformer having a high electrothermic efficiency is characterized in that a plurality of heat exchange elements each of which has a catalyst for burning reaction on one face of a barrier plate and a catalyst for a steam reforming reaction, a catalyst for a water-gas-shift reaction and a catalyst for a selective oxidn. of carbon monoxide on the other face thereof are laminated. The above catalysts are suitable for use in a **hydrogen generator** for a solid polymer type **fuel cell**, since it has a high activity at a relatively low temp. and is reduced in the byprodn. of carbon monoxide.

IT **7429-90-5**, Aluminum, uses **7440-50-8**, Copper, uses
(catalyst for plate-fin heat exchange-type reformer)

RN 7429-90-5 HCA

CN Aluminum (8CI, 9CI) (CA INDEX NAME)

Al

RN 7440-50-8 HCA

CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IC ICM B01J023-72
ICS B01J023-80; B01J023-745; B01J023-46; B01J037-02; C01B003-32; C01B003-38; H01M008-06; C10G011-02; C10K001-32
CC 67-1 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)
IT **7429-90-5**, Aluminum, uses **7440-50-8**, Copper, uses
12597-68-1, Stainless steel, uses
(catalyst for plate-fin heat exchange-type reformer)

L35 ANSWER 12 OF 19 HCA COPYRIGHT 2005 ACS on STN
134:149910 Autothermal methanol reforming for **hydrogen production** in **fuel cell** applications.
Geissler, Konrad; Newson, Esmond; Vogel, Frederic; Truong, Thanh-Binh; Hottinger, Peter; Wokaun, Alexander (Laboratory for Energy and Material Cycles, Paul Scherrer Institute, Villigen-PSI, CH-5232, Switz.). Physical Chemistry Chemical Physics, 3(3), 289-293 (English) **2001**. CODEN: PPCPFQ. ISSN: 1463-9076. Publisher: Royal Society of Chemistry.
AB **Fuel cell** powered elec. cars using on-board methanol reforming to **produce** a **hydrogen**-rich gas represent a low-emissions alternative to gasoline internal combustion engines (ICE). In order to exceed the well-to-wheel efficiencies of 17% for the gasoline ICE, high-efficiency **fuel cells** and methanol reformers must be developed. Catalytic autothermal reforming of methanol offers advantages over **endothermic** steam-reforming and **exothermic** partial oxidn. Microreactor testing of copper-contg. catalysts was carried out at 250-330.degree. showing nearly complete methanol conversion at 85% hydrogen yield. For the overall process a simplified model of the reaction network, consisting of the total oxidn. of methanol, the reverse water-gas shift reaction, and the steam-reforming of methanol, is proposed. Individual kinetic measurements for the latter two reactions on a com. Cu/ZnO/Al2O3 catalyst are presented.
IT **1333-74-0P**, Hydrogen, uses
(autothermal methanol steam reforming for **hydrogen prodn.** in **fuel cell** applications)
RN 1333-74-0 HCA
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

IT **7440-50-8P**, Copper, uses

(autothermal methanol steam reforming in copper-zinc oxide-alumina catalyst for **hydrogen prodn.** in **fuel cell** applications)
RN 7440-50-8 HCA
CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

CC 52-1 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 51
ST methanol steam reforming **hydrogen prodn** **fuel cell**; reverse water gas shift reaction methanol reforming
IT **Fuel cells**
Steam reforming
(autothermal methanol steam reforming for **hydrogen prodn.** in **fuel cell** applications)
IT Reforming catalysts
(autothermal methanol steam reforming in copper-zinc oxide-alumina catalyst for **hydrogen prodn.** in **fuel cell** applications)
IT Water gas shift reaction
(water-gas shift reaction in autothermal methanol steam reforming for **hydrogen prodn.** in **fuel cell** applications)
IT **1333-74-0P**, Hydrogen, uses
(autothermal methanol steam reforming for **hydrogen prodn.** in **fuel cell** applications)
IT 67-56-1, Methanol, uses
(autothermal methanol steam reforming for **hydrogen prodn.** in **fuel cell** applications)
IT 1314-13-2, Zinc oxide (ZnO), uses 1344-28-1, Alumina, uses
(autothermal methanol steam reforming in copper-zinc oxide-alumina catalyst for **hydrogen prodn.** in **fuel cell** applications)
IT **7440-50-8P**, Copper, uses
(autothermal methanol steam reforming in copper-zinc oxide-alumina catalyst for **hydrogen prodn.** in **fuel cell** applications)

L35 ANSWER 13 OF 19 HCA COPYRIGHT 2005 ACS on STN
133:337409 Catalytic **production** of **hydrogen** from methanol. de Wild, P. J.; Verhaak, M. J. F. M. (Netherlands Energy Research Foundation ECN, Petten, 1755 ZG, Neth.). Catalysis Today, 60(1-2), 3-10 (English) **2000**. CODEN: CATTEA. ISSN: 0920-5861. Publisher: Elsevier Science B.V..
AB Catalytic **prodn.** of **hydrogen** by steam reforming

of methanol is an attractive option for use in decentralized prodn. of clean elec. energy from **fuel cells**. Methanol fuelled solid polymer **fuel cell** (SPFC) systems are promising candidates for stationary and mobile applications such as passenger cars. Present methanol reformers are usually of the packed bed type which suffer from problems such as the occurrence of hot and cold spots and the slow response at start-up and during transients. These disadvantages are due to the slow heat transfer in the packed bed. Metal-supported catalyst systems that integrate the **endothermic** methanol steam reforming with the **exothermic** combustion of methanol or hydrogen contg. gas from the **fuel cell** offer good heat transfer characteristics which are beneficial for the dynamical response at start-up and during transients. For methanol steam reforming, the concept of a washcoated heat exchanger showed better performance as compared to washcoated foam and packed beds. This is attributed to the good heat transfer characteristics of the heat exchanger. More than 600 L/h of **hydrogen** can be **generated** at methanol conversions higher than 95%. By proper temp. control, 450-h continuous operation has been achieved with a washcoated reactor at an av. methanol conversion >90%.

IT **7440-50-8**, Copper, uses
(catalytic **prodn**. of **hydrogen** from methanol)
RN 7440-50-8 HCA
CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IT **1333-74-0P**, **Hydrogen**, uses
(catalytic **prodn**. of **hydrogen** from methanol)
RN 1333-74-0 HCA
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

IT **7429-90-5**, Aluminum, uses
(supports; catalytic **prodn**. of **hydrogen** from methanol)
RN 7429-90-5 HCA
CN Aluminum (8CI, 9CI) (CA INDEX NAME)

Al

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 49, 52, 67

ST hydrogen prodn methanol steam reforming
IT Catalyst supports
Heat exchangers
Steam reforming catalysts
(catalytic **prodn.** of **hydrogen** from methanol)
IT Reactors
(catalytic; catalytic **prodn.** of **hydrogen** from methanol)
IT Metals, uses
(foams, catalyst supports; catalytic **prodn.** of **hydrogen** from methanol)
IT Foams
(metal, catalyst supports; catalytic **prodn.** of **hydrogen** from methanol)
IT Reactors
(packed-bed; catalytic **prodn.** of **hydrogen** from methanol)
IT Synthesis gas manufacturing
(steam reforming synthesis gas manufg.; catalytic **prodn**. of **hydrogen** from methanol)
IT Reforming apparatus
(steam; catalytic **prodn.** of **hydrogen** from methanol)
IT **7440-50-8**, Copper, uses
(catalytic **prodn.** of **hydrogen** from methanol)
IT **1333-74-0P**, **Hydrogen**, uses
(catalytic **prodn.** of **hydrogen** from methanol)
IT 67-56-1, Methanol, uses
(catalytic **prodn.** of **hydrogen** from methanol)
IT **7429-90-5**, Aluminum, uses
(supports; catalytic **prodn.** of **hydrogen** from methanol)

L35 ANSWER 14 OF 19 HCA COPYRIGHT 2005 ACS on STN
132:281464 Method for driving a reformer and co-oxidation unit. Boneberg, Stefan; Brauchle, Stefan; Georg, Dirk; Gurtler, Joachim; Schafer, Martin; Schussler, Martin; Wolfsteiner, Matthias (DBB Fuel Cell Engines Gesellschaft Mit Beschrankter Haftung, Germany). Eur. Pat. Appl. EP 995716 A1 **20000426**, 7 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO. (German). CODEN: EPXXDW. APPLICATION: EP 1999-118368 19990916. PRIORITY: DE 1998-19847211 19981013.
AB An **endothermic** catalytic steam reformer is operated in combination with an **exothermic** catalytic CO oxidn. unit for **prodn.** of **H2**-rich gases under controlled O2 (air) feeding. The units are coupled thermally by a heat-conductive wall. The reformer and combustor can be used for transformation of

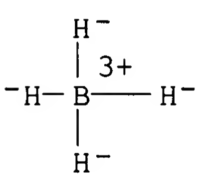
```
     MeOH to H2 and CO2, e.g., for use in fuel cells.
IT   7440-06-4, Platinum, uses
        (method for driving a thermally coupled steam reformer and
        co-oxidn. unit)
RN   7440-06-4  HCA
CN   Platinum (8CI, 9CI)  (CA INDEX NAME)

Pt

IT   1333-74-0P, Hydrogen, preparation
        (method for driving a thermally coupled steam reformer and
        co-oxidn. unit)
RN   1333-74-0  HCA
CN   Hydrogen (8CI, 9CI)  (CA INDEX NAME)

H— H

IC   ICM  C01B003-58
     ICS  B01J019-00; B01J008-02; B01J012-00
CC   51-11 (Fossil Fuels, Derivatives, and Related Products)
     Section cross-reference(s): 47, 49, 52, 67
ST   synthesis gas manufg coupled reformer oxidn unit; hydrogen
     manufg coupled reformer oxidn unit; steam reformer oxidn
     unit thermal coupling
IT   Combustion
     Combustion apparatus
       Fuel cells
     Process control
        (method for driving a thermally coupled steam reformer and
        co-oxidn. unit)
IT   1344-28-1, Alumina, uses 7440-06-4, Platinum, uses
     7440-18-8, Ruthenium, uses
        (method for driving a thermally coupled steam reformer and
        co-oxidn. unit)
IT   124-38-9P, Carbon dioxide, preparation 1333-74-0P,
     Hydrogen, preparation
        (method for driving a thermally coupled steam reformer and
        co-oxidn. unit)

L35  ANSWER 15 OF 19  HCA  COPYRIGHT 2005 ACS on STN
132:52316  Production of hydrogen from chemical
     hydrides via hydrolysis with steam.  Aiello, R.; Sharp, J.
     H.; Matthews, M. A. (Department of Chemical Engineering, University
     of South Carolina, Columbia, SC, 29208, USA).  International Journal
     of Hydrogen Energy, 24(12), 1123-1130 (English) 1999.
     CODEN: IJHEDX.  ISSN: 0360-3199.  Publisher: Elsevier Science Ltd..
```

AB The objective of this work is to develop a method of **producing H2** for use in hand-portable **fuel cells** eliminating the bulkiness and high pressures assocd. with storage tanks. Water, either as liq. or vapor, will react with solid **hydrides** such as $NaBH_4$ to **produce** pure **hydrogen**. However, a no. of limitations are inherent in the liq.-solid reaction. The insol. hydrolysis products are extremely basic and high pH inhibits the reaction. A large excess of acid must be added to the mixt. in order to force the reaction to completion, but is detrimental to the equipment. Furthermore, the liq.-solid reaction is inefficient on a wt. basis because a large excess of the water-acid mixt. must be used to obtain acceptable yields of hydrogen. Exploiting the vapor-solid reaction overcomes some of these limitations. An isothermal semi-batch reactor was constructed to test the concept. In each expt. the reactor was loaded with one gram of **hydride** and ambient pressure steam was metered through the reactor. A GC anal. of the product gas detected only hydrogen and water. The yield of hydrogen was measured and compared to the theor. yield. The pH of the condensed, unreacted steam was tested and the percentage of excess water used was measured. A statistical anal. was conducted on the results in order to det. interactions between the parameters of flow rate and temp. For some hybrides, nearly 100% yield of hydrogen was obtained without addn. of any acid. Hydrogen yield depended strongly on temp. and, to a lesser extent, on flow rate of steam. The results and thermodn. anal. suggest a conceptual **hydrogen generation** system in which the **exothermic** hydrolysis reaction is linked to an **endothermic dehydriding** reaction for the purpose of **producing** addnl. **hydrogen**.

IT **16940-66-2**, Sodium **borohydride**
(**prodn**. of **hydrogen** from chem. **hydrides** via hydrolysis with steam)

RN 16940-66-2 HCA

CN Borate(1-), tetrahydro-, sodium (8CI, 9CI) (CA INDEX NAME)



IT **1333-74-0P, Hydrogen, preparation**
(**prodn.** of **hydrogen** from chem.
hydrides via hydrolysis with steam)
RN 1333-74-0 HCA
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 49
ST portable **fuel cell** hydrogen **hydride**
hydrolysis
IT **Fuel cells**
(portable; **prodn.** of **hydrogen** from chem.
hydrides via hydrolysis with steam)
IT Hydrolysis
(**prodn.** of **hydrogen** from chem.
hydrides via hydrolysis with steam)
IT **16940-66-2**, Sodium **borohydride**
(**prodn.** of **hydrogen** from chem.
hydrides via hydrolysis with steam)
IT **1333-74-0P, Hydrogen, preparation**
(**prodn.** of **hydrogen** from chem.
hydrides via hydrolysis with steam)

L35 ANSWER 16 OF 19 HCA COPYRIGHT 2005 ACS on STN
130:254853 Reformers for **fuel cells.** Mizuno, Seiji; Ozaki, Toshiaki; Kawahara, Tatsuya; Taki, Tadayoshi; Kinoshita, Katsuhiko; Negishi, Yoshimasa (Toyota Motor Corp., Japan). Jpn. Kokai Tokkyo Koho JP 11092102 A2 **19990406** Heisei, 40 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1998-210354 19980708. PRIORITY: JP 1997-214112 19970723.
AB The reformers, for **generating H** by an **endothermic** steam reforming a hydrocarbon, while generating heat from an **exothermic** oxidn. of the hydrocarbon for the reforming reaction, have a catalytic zone contg. catalysts for the reforming and oxidizing reactions, a means supplying a raw fuel gas contg. the hydrocarbon and steam and O to the catalytic zone, means for discharging the H rich reformed gas from the catalytic zone, and a means at the catalytic zone to control the raw fuel gas at an appropriate flow rate to carry sufficient amt. of the heat generated by the oxidn. to the downstream side.
IC ICM C01B003-38
ICS H01M008-06
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST **fuel cell** catalytic reformer
IT **Fuel cells**

Reforming apparatus
(structure of reformers contg. catalytic reforming and catalytic oxidizing zones for **fuel cells**)

L35 ANSWER 17 OF 19 HCA COPYRIGHT 2005 ACS on STN
130:69139 Method and apparatus for reforming of **fuels** and **fuel cell** systems equipped with the apparatus.
Hirata, Toshiyuki (Toyota Motor Corp., Japan). Jpn. Kokai Tokkyo Koho JP 11001302 A2 **19990106** Heisei, 18 pp. (Japanese).
CODEN: JKXXAF. APPLICATION: JP 1997-169566 19970610.

AB In multistep reforming of fuels, O is fed into reaction chambers for generation of heat by oxidn. reaction, and the generated heat is utilized in the **endothermic** reforming reaction. The amts. of O fed into the reaction chambers are controlled depending on the state of each reforming reactions. The app. comprises (1) reforming chambers contg. reforming catalysts and oxidn. catalysts, (2) means for detection of reforming reaction states, (3) means for O feeding, and (4) means for controlling the O amt. **Fuel cell** systems consisting of the above reforming app. and **fuel cells** are also claimed. Reforming is carried out effectively with efficient utilization of heat of oxidn.

IT **1333-74-0P**, Hydrogen, uses
(**fuel cell** power generation systems equipped with reforming app. utilizing heat of oxidn. for activation of **endothermic** reforming reaction)
RN 1333-74-0 HCA
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

IT **7440-06-4**, Platinum, uses
(oxidn. catalyst; **fuel cell** power generation systems equipped with reforming app. utilizing heat of oxidn. for activation of **endothermic** reforming reaction)
RN 7440-06-4 HCA
CN Platinum (8CI, 9CI) (CA INDEX NAME)

Pt

IT **7440-50-8**, Copper, uses
(reforming catalyst; **fuel cell** power generation systems equipped with reforming app. utilizing heat of oxidn. for activation of **endothermic** reforming reaction)
RN 7440-50-8 HCA
CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IC ICM C01B003-38
ICS H01M008-06
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 51
ST **fuel cell** system reforming app; oxidn heat utilization **endothermic** fuel reforming; oxygen feeding **endothermic** fuel reforming activation
IT Oxidation enthalpy
Process control
Reforming apparatus
(**fuel cell** power generation systems equipped with reforming app. utilizing heat of oxidn. for activation of **endothermic** reforming reaction)
IT **Exothermic** reaction
(oxidn.; **fuel cell** power generation systems equipped with reforming app. utilizing heat of oxidn. for activation of **endothermic** reforming reaction)
IT **Fuel cells**
(power plants; **fuel cell** power generation systems equipped with reforming app. utilizing heat of oxidn. for activation of **endothermic** reforming reaction)
IT 7782-44-7, Oxygen, uses
(controlled feeding of; **fuel cell** power generation systems equipped with reforming app. utilizing heat of oxidn. for activation of **endothermic** reforming reaction)
IT **1333-74-0P**, Hydrogen, uses
(**fuel cell** power generation systems equipped with reforming app. utilizing heat of oxidn. for activation of **endothermic** reforming reaction)
IT 67-56-1, Methanol, reactions
(**fuel cell** power generation systems equipped with reforming app. utilizing heat of oxidn. for activation of **endothermic** reforming reaction)
IT **7440-06-4**, Platinum, uses
(oxidn. catalyst; **fuel cell** power generation systems equipped with reforming app. utilizing heat of oxidn. for activation of **endothermic** reforming reaction)
IT **7440-50-8**, Copper, uses 7440-66-6, Zinc, uses
(reforming catalyst; **fuel cell** power generation systems equipped with reforming app. utilizing heat of oxidn. for activation of **endothermic** reforming reaction)

L35 ANSWER 18 OF 19 HCA COPYRIGHT 2005 ACS on STN
128:206686 On-board **hydrogen generation** for transport applications: the HotSpot methanol processor. Edwards, Neil; Ellis, Suzanne R.; Frost, Jonathan C.; Golunski, Stanislaw E.; van Keulen, Arjan N. J.; Lindewald, Nicklas G.; Reinkingh, Jessica G. (Sonning Common, Blount's Court, Johnson Matthey Technology Centre, Reading, UK). Journal of Power Sources, 71(1,2), 123-128 (English) **1998**. CODEN: JPSODZ. ISSN: 0378-7753. Publisher: Elsevier Science S.A..

AB In the absence of a hydrogen infrastructure, development of effective on-board fuel processors is likely to be crit. to the commercialization of **fuel-cell** cars. The HotSpot reactor converts methanol, water and air in a single compact catalyst bed into a reformate contg. mainly CO2 and hydrogen (and unreacted nitrogen). The process occurs by a combination of **exothermic** partial oxidn. and **endothermic** steam reforming of methanol, to produce 750 L of hydrogen/h from a 245-cm3 reactor. The relative contribution of each reaction can be tuned to match the system requirements at a given time. Scale-up is achieved by the parallel combination of the required no. of individual HotSpot reactors, which are fed from a central manifold. Using this modular design, the start-up and transient characteristics of a large fuel-processor are identical to that of a single reactor. When vaporized liq. feed and air are introduced into cold reactors, 100% output is achieved in 50 s; subsequent changes in throughput result in instantaneous changes in output. Surplus energy within the **fuel-cell** power train can be directed to the manifold, where it can be used to vaporize the liq. feeds and so promote steam reforming, resulting in high system efficiency. The small amt. of CO that is produced by the HotSpot reactions is attenuated to <10 ppm by a catalytic clean-up unit. The HotSpot concept and CO clean-up strategy are not limited to the processing of methanol, but are being applied to other org. fuels.

IT **1333-74-0P, Hydrogen, preparation**
(on-board **hydrogen generation** for transport applications by the HotSpot methanol processor)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H— H

CC 52-1 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **hydrogen** onboard **generation** transport application

IT **Fuel cells**
(on-board **hydrogen generation** for transport applications by the HotSpot methanol processor)

IT 67-56-1, Methanol, reactions
(on-board **hydrogen generation** for transport applications by the HotSpot methanol processor)
IT **1333-74-0P, Hydrogen, preparation**
(on-board **hydrogen generation** for transport applications by the HotSpot methanol processor)

L35 ANSWER 19 OF 19 HCA COPYRIGHT 2005 ACS on STN
100:10011 Hydrogen **fuel cells.** (Matsushita Electric Industrial Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 58121566 A2 **19830719** Showa, 3 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1982-4590 19820113.
AB H **fuel cells** have a concentric **H storage** unit with an inner and an outer compartments to operate absorption-desorption cycle in an alternate manner to use the **exothermic** and **endothermic** effects in **H** delivery and **storage.** Thus, a stacked H-O fuel used an inner concentric **H storage** unit filled with Ti-Mn1.5. The cell output was 0.7 .+-. 0.02 V in 5000-h operation and the **fuel cell** start-up time was .ltoreq.0.5 h.
IC H01M008-06
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST hydrogen oxygen **fuel cell; storage hydrogen fuel cell**
IT **Fuel cells**
(hydrogen-oxygen, with concentric inner **hydrogen-storage hydride** unit)

=> d 136 1-22 cbib abs hitstr hitind

L36 ANSWER 1 OF 22 HCA COPYRIGHT 2005 ACS on STN
140:113996 Liquid water and air injection for improved management of an autothermal reformer. Robb, Gary M. (General Motors Corp., USA). U.S. Pat. Appl. Publ. US 2004022724 A1 20040205, 11 pp. (English). CODEN: USXXCO. APPLICATION: US 2002-211845 20020802.
AB An autothermal reformer combining an **endothermic** steam reforming process with an **exothermic** fuel combustion process is managed by injection of preheated liq. water in combination with superheated steam and compressed air to support transient, startup and semi-continuous operation. The injection rate or vol. of the liq. water and air is based on measured variables of the primary reactor.
IT **1333-74-0P, Hydrogen, preparation**
(liq. water and air injection for improved management of autothermal reformer)
RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

IC ICM C01B003-26
INCL 423651000; 423652000; 422187000; 122466000; 122483000; 122479100
CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 52
IT Air
Fuel cells
Steam
(liq. water and air injection for improved management of autothermal reformer)
IT **1333-74-0P, Hydrogen, preparation**
(liq. water and air injection for improved management of autothermal reformer)

L36 ANSWER 2 OF 22 HCA COPYRIGHT 2005 ACS on STN
140:96826 Catalyst configurations for indirect internal steam reforming in SOFCs. Aguiar, P.; Ramirez-cabrera, E.; Atkinson, A.; Kershenbaum, L. S.; Chadwick, D. (Department of Chemical Engineering, Imperial College of Science, Technology and Medicine, London, SW7, UK). Proceedings - Electrochemical Society, 2001-16(Solid Oxide Fuel Cells VII), 703-711 (English) **2001**. CODEN: PESODO. ISSN: 0161-6374. Publisher: Electrochemical Society.
AB Indirect internal steam reforming of CH_4 in SOFCs requires efficient thermal coupling of the **endothermic** reforming reaction to the **exothermic** electrochem. oxidn. reactions. However, if the reforming reaction is too fast, local cooling can result in thermally-induced fracture of the ceramic components. This can be alleviated by controlling the reforming rate and the heat transfer. The approach to this problem was 2-fold. Firstly, to develop oxide-based steam reforming catalysts which have a lower activity than conventional steam reforming catalysts while being highly resistant to C deposition, and, secondly, to control the reaction rate by mass transfer. The latter can be achieved by the introduction of a diffusive barrier near the outer surface of the catalyst. An overview of exptl. and modeling studies is presented. The modeling results demonstrate how the different strategies can fulfil the overall requirements for controlling heat flows and chem. reaction rates. In the case of controlled activity oxide catalysts, exptl. data for steam reforming over ceria catalysts is presented which show that these approach the activity requirements.
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 67
ST methane steam reforming catalyst model solid oxide **fuel**

cell

IT **Fuel cells**
(solid oxide; catalyst configurations for indirect internal steam reforming in SOFCs)

IT 124-38-9, Carbon dioxide, formation (nonpreparative) 630-08-0, Carbon monoxide, formation (nonpreparative) 1333-74-0, **Hydrogen, formation** (nonpreparative)
(in catalyst configurations for indirect internal steam reforming in SOFCs)

L36 ANSWER 3 OF 22 HCA COPYRIGHT 2005 ACS on STN

140:62377 Gasification of lignocellulose for generation of electricity from **fuel cells**. Lightner, Gene E. (USA). U.S. Pat. Appl. Publ. US 2004009378 A1 20040115, 6 pp. (English). CODEN: USXXCO. APPLICATION: US 2002-191896 20020709.

AB Prodn. of electricity originates by providing a supply of lignocellulose and a vessel for gasification and subjecting the lignocellulose to gasification to afford access to **fuel cells**; thereupon conveying products of gasification to a stack of **fuel cells** and providing air to the **fuel cells** for reaction of oxygen within air, hence generating d.c. and **exothermic** heat transferred to the gasification vessel as **endothermic** heat. Resulting d.c. is converted to a.c. to supply a.c. to a power main. Residue, remaining from gasification, is subjected to disposal. Thereby d.c. from a stack of **fuel cells** is generated by gasification of lignocellulose.

IT **1333-74-0P**, Hydrogen, uses
(gasification of lignocellulose for generation of electricity from **fuel cells**)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

IC ICM H01M008-06

INCL 429017000; 429020000

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 43, 60

ST lignocellulose gasification electricity generation **fuel cell**

IT Reactors
(fluidized-bed; gasification of lignocellulose for generation of electricity from **fuel cells**)

IT **Fuel cells**
Municipal refuse
Thermal decomposition

Water vapor
Wood
(gasification of lignocellulose for generation of electricity from **fuel cells**)

IT Volatile organic compounds
(gasification of lignocellulose for generation of electricity from **fuel cells**)

IT Fuel gas manufacturing
(gasification, fluidized-bed; gasification of lignocellulose for generation of electricity from **fuel cells**)

IT Fuel gas manufacturing
(gasification; gasification of lignocellulose for generation of electricity from **fuel cells**)

IT **Fuel cells**
(molten carbonate; gasification of lignocellulose for generation of electricity from **fuel cells**)

IT Fluidized beds
(reactors; gasification of lignocellulose for generation of electricity from **fuel cells**)

IT **Fuel cells**
(solid oxide; gasification of lignocellulose for generation of electricity from **fuel cells**)

IT Paper
(wastepaper; gasification of lignocellulose for generation of electricity from **fuel cells**)

IT 11132-73-3, Lignocellulose
(gasification of lignocellulose for generation of electricity from **fuel cells**)

IT **1333-74-0P**, Hydrogen, uses
(gasification of lignocellulose for generation of electricity from **fuel cells**)

L36 ANSWER 4 OF 22 HCA COPYRIGHT 2005 ACS on STN

140:44729 Solid-oxide **fuel cell** system having an integrated reformer and waste energy recovery system. Kelly, Sean M.; Haltiner, Karl J.; Faville, Michael T.; Schumann, David R. (Delphi Technologies, Inc., USA). U.S. Pat. Appl. Publ. US 2003235726 A1 20031225, 34 pp. (English). CODEN: USXXCO. APPLICATION: US 2002-178808 20020624.

AB A solid-oxide **fuel cell** system includes an integrated reforming unit comprising a hydrocarbon fuel reformer; an integral tail gas and cathode air combustor and reformer heat exchanger; a fuel pre-heater and fuel injector cooler; a fuel injector and fuel/air mixer and vaporizer; a reforming air preheating heat exchanger; a reforming air temp. control valve and means; and a pre-reformer startup combustor. The integration of a plate reformer, tail gas combustor, and combustor gas heat exchanger allows for efficient operation modes of the reformer, both

endothermic and **exothermic** as desired. The
combustor gas heat exchanger aids in temp. regulation of the
reformer and reduces significant thermal gradients in the unit.

IT **1333-74-0P**, Hydrogen, uses
(solid-oxide **fuel cell** system having
integrated reformer and waste energy recovery)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

IC ICM H01M008-06
ICS H01M008-12; B60L011-18

INCL 429020000; 429038000; 429032000; 180065300

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** system integrated reformer waste
energy recovery

IT Ships
(boats; solid-oxide **fuel cell** system having
integrated reformer and waste energy recovery)

IT Engines
(fuel injectors; solid-oxide **fuel cell** system
having integrated reformer and waste energy recovery)

IT Flue gases
(industrial flue gases; solid-oxide **fuel cell**
system having integrated reformer and waste energy recovery)

IT Heat
(recovery; solid-oxide **fuel cell** system
having integrated reformer and waste energy recovery)

IT Fuel gas manufacturing
(reforming; solid-oxide **fuel cell** system
having integrated reformer and waste energy recovery)

IT **Fuel cells**
(solid oxide; solid-oxide **fuel cell** system
having integrated reformer and waste energy recovery)

IT Aircraft
Automobiles
Heat exchangers
Reforming apparatus
Reforming catalysts
Trucks
Waste heat
(solid-oxide **fuel cell** system having
integrated reformer and waste energy recovery)

IT Hydrocarbons, processes
(solid-oxide **fuel cell** system having
integrated reformer and waste energy recovery)

IT **1333-74-0P**, Hydrogen, uses
(solid-oxide **fuel cell** system having integrated reformer and waste energy recovery)

L36 ANSWER 5 OF 22 HCA COPYRIGHT 2005 ACS on STN
139:294338 Manufacture and use of an apparatus for combining two heterogeneous catalyzed reactions such as an **endothermal** and an **exothermal** reaction. Portscher, Markus; Schuessler, Martin (Ballard Power Systems A.-G., Germany). Eur. Pat. Appl. EP 1350562 A1 20031008, 8 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR, BG, CZ, EE, HU, SK. (German). CODEN: EPXXDW. APPLICATION: EP 2003-5348 20030312. PRIORITY: DE 2002-10214293 20020328.

AB The app., suitable for use in reforming of fuels and oxidants to form a **product** gas contg. **hydrogen**, has a thin porous reforming catalyst layer, through which the reactants flow vertically, which is connected to an oxidn. catalyst layer facing a dosing layer through which the oxidant flows. The reformate is essentially spread homogeneously over the oxidn. catalyst and faces the homogeneously spread oxidant coming from the dosing layer. The app. is esp. suitable for use in a **fuel cell** system for **hydrogen formation**.

IT **1333-74-0P**, **Hydrogen**, **preparation**
(**manuf**. and use of an app. for combining two heterogeneous catalyzed reactions such as an **endothermal** and an **exothermal** reaction)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

IC ICM B01J019-24
ICS B01J012-00; C01B003-32; C01B003-38; C01B003-58; H01M008-06

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 52

ST **hydrogen prepn fuel cell** catalyst app

IT **Fuel cells**
Fuels
Oxidation catalysts
Oxidizing agents
Reforming
Reforming apparatus
Reforming catalysts
(manuf. and use of an app. for combining two heterogeneous catalyzed reactions such as an **endothermal** and an

exothermal reaction)

IT **1333-74-0P, Hydrogen, preparation**
(**manuf.** and use of an app. for combining two heterogeneous catalyzed reactions such as an **endothermal** and an **exothermal** reaction)

L36 ANSWER 6 OF 22 HCA COPYRIGHT 2005 ACS on STN

138:341118 Catalytic-coated plate reactor for a gas production system of a **fuel cell.** Anumu, Philip Atte; Brauchle, Stefan; Schuessler, Martin (Ballard Power Systems A.-G., Germany). Ger. Offen. DE 10151393 A1 20030508, 6 pp. (German). CODEN: GWXXBX. APPLICATION: DE 2001-10151393 20011018.

AB The invention concerns a plate reactor for a gas prodn. system of a **fuel cell** for the **prodn.** of a **H_2** -contg. gas. The plates are arranged for the construction of medium areas alternating for **exothermal** reactions (esp. selective oxidn.), and medium areas for **endothermic** reactions (esp. steam reforming), whereby the medium areas have heat dissipating contact to each other. The medium areas for the **exothermal** reactions are equipped with catalytic-coated plates. An additive, esp. O_2, resp. air is dosed into the **exothermal** reaction chamber. The reactor is suitable for the fuel gas manufg. by partial oxidn., and/or reforming in a **fuel cell** plant of a mobile unit, esp. in a vehicle.

IT **1333-74-0P, Hydrogen, preparation**
(**manuf.** in catalytic-coated plate reactor for a gas prodn. system of a **fuel cell**)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H— H

IC ICM H01M008-06
ICS C01B003-00

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

IT **Fuel cells**
(catalytic-coated plate reactor for a gas prodn. system of a)

IT Electric vehicles
(catalytic-coated plate reactor for a gas prodn. system of a **fuel cell** for)

IT Fuel gas manufacturing
(partial oxidn.; in catalytic-coated plate reactor for a gas prodn. system of a **fuel cell**)

IT Reactors
(plate reactor; for a gas prodn. system of a **fuel cell**)

IT Fuel gas manufacturing

(steam reforming; in catalytic-coated plate reactor for a gas prodn. system of a **fuel cell**)

IT **1333-74-0P**, **Hydrogen**, **preparation**
(**manuf.** in catalytic-coated plate reactor for a gas prodn. system of a **fuel cell**)

L36 ANSWER 7 OF 22 HCA COPYRIGHT 2005 ACS on STN

138:192246 System and method for carbon dioxide recovery from fuel combustion gas. Murata, Keiji; Hagiwara, Yoshikazu; Yamada, Kazuya (Toshiba Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2003054927 A2 20030226, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-247697 20010817.

AB The system has a reactor contg. (1) fuel reforming catalysts for **endothermic** reaction of C-contg. fuels with water vapor to **form** CO2 and **H** and (2) CO2 absorbers (e.g., Li mixed oxides) for **exothermic** absorption reaction. The fuels and the vapor are introduced into the reactor to simultaneously carry out the above reactions. Reformed fuels or a part of the C-contg. fuels are burned to form a combustion gas, by which the CO2 absorbers are heated to release CO2. The system is suitable for combustion furnaces, boilers, gas turbines, gas engines, **fuel cells**, power generators, etc., and energy for CO2 recovery is decreased in the system and the method.

IT **1333-74-0P**, Hydrogen, uses
(reformed gas contg.; CO2 recovery from fuel combustion gas with fuel reforming catalysts and CO2 absorbers)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

IC ICM C01B031-20
ICS C01B031-20; C01B003-32; C01B003-38; C01B003-58

CC 59-4 (Air Pollution and Industrial Hygiene)
Section cross-reference(s): 51, 52

IT **1333-74-0P**, Hydrogen, uses
(reformed gas contg.; CO2 recovery from fuel combustion gas with fuel reforming catalysts and CO2 absorbers)

L36 ANSWER 8 OF 22 HCA COPYRIGHT 2005 ACS on STN

138:6371 Performance analysis of polymer electrolyte water electrolysis cell at a small-unit test cell and performance prediction of large stacked cell. Onda, Kazuo; Murakami, Toshio; Hikosaka, Takeshi; Kobayashi, Misaki; Notu, Ryouhei; Ito, Kohei (Department of Electrical and Electronic Engineering, Toyohashi University of Technology, Toyohashi, 441-8580, Japan). Journal of the Electrochemical Society, 149(8), A1069-A1078 (English) **2002**

. CODEN: JESOAN. ISSN: 0013-4651. Publisher: Electrochemical Society.

AB Recently the hydrogen energy system has been proposed as a countermeasure for the depletion of fossil fuel and global warming. The polymer electrolyte electrolysis cell (PEEC) can efficiently **produce** pure **hydrogen** under high c.d. To design a PEEC properly and to optimize its operating conditions we have measured and analyzed the PEEC performance. Using measured overpotentials we have made a two-dimensional simulation code for PEEC. Calcd. results show that the profile of c.d. and temp. are const. along the water flow direction, because the **exothermic** heat from overpotentials is almost canceled out by the **endothermic** heat of both entropy change and evapn., and by heat transfer to the const.-temp. separators, resulting in a const. water-electrolyzing potential along the flow direction. The current densities measured at a segmented-electrode cell agreed well with the calcd. values. By applying this simulation code to a large unit-cell with adiabatic boundary conditions, we have predicted the performance of a large stacked PEEC having an electrode length of 1 m. The predicted cell temp. and c.d. increase only a little along the flow direction. Under operating conditions with high pressure, the **endothermic** heat of water evapn. decreases greatly and the cell temp. is apt to increase downstream compared to the atm. operation.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** electrolyte performance analysis

IT **Fuel cell** electrolytes
Polymer electrolytes
Simulation and Modeling
(performance anal. of polymer electrolyte water electrolysis cell at a small-unit test cell and performance prediction of large stacked cell)

L36 ANSWER 9 OF 22 HCA

137:372165 Catalytic separator plate reactor and method of catalytic reforming of fuel to hydrogen. Loffler, Daniel A.; Faz, Carlos E.; Sokolovskii, Valery; Iglesia, Enrique (USA). U.S. Pat. Appl. Publ. US 2002168308 A1 **20021114**, 23 pp., Cont.-in-part of U.S. Pat. Appl. 2002 71,797. (English). CODEN: USXXCO. APPLICATION: US 2001-972142 20011005. PRIORITY: US 2000-PV238867 20001006; US 2000-737268 20001213.

AB Modular, stackable, flow-through plate or channel reactor units are disclosed for continuous, low-temp., catalytic reactions of 2 sep. process reaction streams; an **exothermic** combustion process and an **endothermic** reforming process. Each reactor unit comprises 2 sep. sets of flow channels or slot-type reaction zones formed in flow plates located between spaced, thin metal, highly heat-conductive metal foil or platelet separator walls, adjacent

reactors in a stack including a common, medially located, bi-catalytic separator plate, i.e., a separator plate having on opposed surfaces the same or different catalysts selected for the particular reaction taking place in the adjacent reactor zone. Each flow plate has a relieved medial area defining the reaction zone, the side walls of which are the catalyst coated separator platelets. A separator platelet separates 2 adjacent reaction zones, one on each side and functions to transfer heat from the combustion occurring at the catalyst surface in the combustion zone directly to the reforming catalyst coated on the opposed surface. The reaction zones may include structures such as grooved plates or packed spheres to direct the feedstock gases to the catalyst coated on the platelet surfaces. Support frames, gaskets, manifolding, insulating spacers, end plates and assembly hardware and methods are also disclosed. Multiple modular reactor units or cells may be stacked to provide a reactor of any desired throughput capacity and portability. The invention also comprises methods for the catalytic reforming of hydrocarbon fuels for the prodn. of **synthesis** gas or **H2** employing the bi-catalytic reactor.

IT **1333-74-0P, Hydrogen, preparation**
(catalytic separator plate reactor and method of catalytic reforming of fuel to hydrogen)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H— H

IC ICM B01J008-02
ICS B01J008-04

INCL 422211000

CC 49-1 (Industrial Inorganic Chemicals)
Section cross-reference(s): 52

ST catalytic separator plate reactor fuel reforming **hydrogen manuf**; synthesis gas manuf catalytic separator plate reactor

IT **Fuel cells**
(catalytic separator plate reactor and method of catalytic reforming of fuel to hydrogen for)

IT **1333-74-0P, Hydrogen, preparation**
(catalytic separator plate reactor and method of catalytic reforming of fuel to hydrogen)

L36 ANSWER 10 OF 22 HCA COPYRIGHT 2005 ACS on STN

136:296896 Catalytic separator plate reactor and method of catalytic reforming of fuel to hydrogen. Loffler, Daniel G.; Faz, Carlos F.; Sokolovskii, Valery; Iglesia, Enrique (Catalytica Energy Systems, USA). PCT Int. Appl. WO 2002028769 A2 **20020411**, 44 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR,

BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2001-US42530 20011005. PRIORITY: US 2000-PV238867 20001006; US 2000-737268 20001213.

AB Modular, stackable, flow-through plate or channel reactor units for continuous, low temp., catalytic reactions of two sep. process reaction streams; typically the first is an **exothermic** combustion process and the second, an **endothermic** reforming process. Each reactor unit comprises two sep. sets of flow channels or slot-type reaction zones formed in flow plates located between spaced, thin metal, highly heat-conduction metal foil or platelet separator walls, adjacent reactors in a stack including a common, medially located, bicatalytic separator plate, i.e., a separator plate having on opposed surfaces the same or different catalysts selected for the particular reaction taking place in the adjacent reactor zone. Each flow plate has a relieved medical area defining the reaction zone, the side walls of which are the catalyst coated separator platelets. A separator platelet thus separates two adjacent reaction zones, one on each side and functions to transfer heat from the combustion occurring at the catalyst surface in the combustion zone directly to the reforming catalyst coated on the opposed surface. The reaction zones may include structures such as grooved plates or packed spheres to direct the feedstock gases to the catalyst coated on the platelet surfaces. Support frames, gaskets, manifolding, insulating spacers, end plates and assembly hardware and methods are also disclosed. Multiple modular reactor units or cells may be stacked to provide a reactor of any desired throughput capacity and portability. The invention also comprises methods for the catalyst reforming of hydrocarbon fuels for the prodn. of **synthesis** gas or **hydrogen** employing the bicatalytic reactor of the invention.

IT **1333-74-0P, Hydrogen, preparation**
(catalytic separator plate reactor and method of catalytic reforming of fuel to hydrogen)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H— H

IC ICM C01B003-00

CC 49-1 (Industrial Inorganic Chemicals)
Section cross-reference(s): 52

ST **hydrogen manuf** catalytic separator reactor steam reforming
IT Catalyst supports
Catalysts
Exothermic reaction
Fuel cells
Heaters
Reactors
Steam reforming
Steam reforming catalysts
(catalytic separator plate reactor and method of catalytic reforming of fuel to hydrogen)
IT Reaction
(**endothermic**; catalytic separator plate reactor and method of catalytic reforming of fuel to hydrogen)
IT **1333-74-0P, Hydrogen, preparation**
(catalytic separator plate reactor and method of catalytic reforming of fuel to hydrogen)

L36 ANSWER 11 OF 22 HCA COPYRIGHT 2005 ACS on STN
135:125053 Solid oxide **fuel cell** operating with an excess of fuel. Thom, Frank (Forschungzentrum Juelich G.m.b.H., Germany). U.S. Pat. Appl. Publ. US 20010010873 A1 **20010802**, 7 pp., Cont.-in-part of WO0016423. (English). CODEN: USXXCO. APPLICATION: US 2001-790096 20010222. PRIORITY: DE 1998-19841970 19980914; DE 1999-19941724 19990902; WO 1999-DE2932 19990911.
AB In a method for operating a SOFC high-temp. **fuel cell**, wherein a hydrogen-contg. fuel is converted internally in the **fuel cell** by an **endothermic** reaction at the anode thereof into a synthesis gas, which is converted by an **exothermic** reaction into electricity, fuel is supplied to the **fuel cell**, to cool the **fuel cell**, in an excess amt. such that, with a predetd. av. c.d. flow, the fuel utilization degree is below 40%, whereas the oxygen is supplied stoichiometrically corresponding to the amt. of electricity generating requirements. No addnl. coolants are therefore required for the cooling of the **fuel cell**.
IT **1333-74-0P**, Hydrogen, uses
(solid oxide **fuel cell** operating with excess of fuel)
RN 1333-74-0 HCA
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H— H

IC H01M008-12

INCL 429017000
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST **fuel cell** operation excess **fuel**
IT Solid state **fuel cells**
Synthesis gas manufacturing
(solid oxide **fuel cell** operating with excess of fuel)
IT Natural gas, reactions
(solid oxide **fuel cell** operating with excess of fuel)
IT **1333-74-0P**, Hydrogen, uses
(solid oxide **fuel cell** operating with excess of fuel)

L36 ANSWER 12 OF 22 HCA COPYRIGHT 2005 ACS on STN
135:109269 Stacked-type reforming reactor with alternating layers of a reforming catalyst and a combustion catalyst. Brauchle, Stefan; Remsch, Tobias; Heil, Dietmar; Schmid, Wolfgang (Xcellsis G.m.b.H., Germany). Eur. Pat. Appl. EP 1116518 A2 **20010718**, 8 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO. (German). CODEN: EPXXDW. APPLICATION: EP 2000-126665 20001205. PRIORITY: DE 2000-10001064 20000113.
AB The reforming catalyst contains alternating layers of a reforming catalyst for an **endothermic** reforming reaction and layers of a combustion catalyst for an **exothermic** reaction. Both catalysts are sepd. by a heat-conducting wall. The vols. of the reforming catalyst layers are greater than those of the combustion catalyst (preferably by a factor of .gtoreq.2). The combustion catalyst functions as a catalytic burner for combustion of CO contained in the reforming gas. The reforming reactor is esp. suitable for **manuf.** of **H2** for **fuel cells** in automobiles.
IT **1333-74-0P, Hydrogen, preparation**
(stacked-type reforming reactor with alternating layers of reforming catalyst and combustion catalyst for)
RN 1333-74-0 HCA
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

IC ICM B01J019-24
ICS B01J008-02; C01B003-58; C01B003-38; C01B003-32
CC 49-1 (Industrial Inorganic Chemicals)
Section cross-reference(s): 52
IT **Fuel cells**
(stacked-type reforming reactor with alternating layers of

reforming catalyst and combustion catalyst for synthesis gas
manuf. for)

IT **1333-74-0P, Hydrogen, preparation**
(stacked-type reforming reactor with alternating layers of
reforming catalyst and combustion catalyst for)

L36 ANSWER 13 OF 22 HCA COPYRIGHT 2005 ACS on STN

134:369458 Laminate-type fuel gas-reforming apparatus for **manufacture** of **hydrogen** for **fuel cells**. Mitsuda, Noriaki; Kotogami, Yoshihide; Tsuchino, Kazunori; Odai, Yoshiaki (Mitsubishi Electric Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2001146401 A2 **20010529**, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-325698 19991116.

AB The app. comprises a laminate of a planar heating cell unit contg. an oxidn. catalyst and a planar reforming cell unit which contains a raw fuel-reforming catalyst and is equipped with an inlet for a raw fuel gas and an outlet for a **manufd. H2**-based gas, wherein a separator is so formed in the reforming cell unit as to zigzag turn the raw fuel gas pass. Alternatively, the reforming cell unit comprises first cell and neighboring second cells, wherein the raw fuel gas is reformed in the first cell and the resulting reformed gas is discharged from the second cell. The structure balances **endothermic** heat of the heating cell unit and **exothermic** heat of the reforming unit, so that the app. provides high reforming efficiency even if there is remarkable undesired temp. distribution in the reforming unit. Thus, MeOH was reformed in the app. into H2 in high yield.

IT **1333-74-0P, Hydrogen, preparation**
(laminate-type fuel gas-reforming app. for **manuf.** of
hydrogen for **fuel cells**)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

IC ICM C01B003-32

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 51

ST **hydrogen manuf** fuel gas reforming app; methanol reforming app **manuf hydrogen**; **cell fuel** plant **hydrogen manuf** reformer

IT Reforming apparatus
(fuel gas; laminate-type fuel gas-reforming app. for
manuf. of **hydrogen** for **fuel cells**)

IT **Fuel cells**
(laminate-type **fuel** gas-reforming app. for

manuf. of **hydrogen** for **fuel**
cells)

IT Fuel gas manufacturing
(reforming, app.; laminate-type fuel gas-reforming app. for **manuf**. of **hydrogen** for **fuel** **cells**)

IT **1333-74-0P, Hydrogen, preparation**
(laminate-type fuel gas-reforming app. for **manuf**. of **hydrogen** for **fuel cells**)

IT 67-56-1, Methanol, reactions
(raw fuel; laminate-type fuel gas-reforming app. for **manuf**. of **hydrogen** for **fuel** **cells**)

L36 ANSWER 14 OF 22 HCA COPYRIGHT 2005 ACS on STN

134:297607 Autothermic reforming reactor. Docter, Andreas; Roeltgen, Uli; Wiesheu, Norbert (Daimlerchrysler A.-G., Germany; Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung E.V.). PCT Int. Appl. WO 2001024922 A1 **20010412**, 24 pp. DESIGNATED STATES: W: US; RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE. (German). CODEN: PIXXD2. APPLICATION: WO 2000-EP9477 20000928. PRIORITY: DE 1999-19947755 19991002.

AB The invention relates to an autothermic reforming reactor, comprising (1) an **endothermic** reaction zone, in which the reforming reaction takes place, (2) an **exothermic** reaction zone, in which the energy is released which is required for the reforming reaction, and (3) a quench zone connected downstream of the reaction zones, for the rapid cooling of the reactor gas vol. flow. The **endothermic** reaction zone and the quench zone are sepd. by a gas permeable heat shield. The latter comprises a thermal insulation for thermally insulating the **endothermic** reaction zone and quench zone in addn. to a thermal radiator which faces the **endothermic** reaction zone and radiates the thermal energy which was absorbed by the reactor gas vol. flow. The reactor is suitable for reforming of hydrocarbons to synthesis gas which is then converted to H2 for **fuel cells**.

IC ICM B01J012-00
ICS H01M008-06; C01B003-38

CC 47-3 (Apparatus and Plant Equipment)
Section cross-reference(s): 49, 52

IT **Fuel cells**
(autothermic reforming reactor for manuf. of synthesis gas in **prodn**. of **hydrogen** for **fuel** **cells**)

IT 1333-74-0, Hydrogen, uses
(autothermic reforming reactor for manuf. of synthesis gas in **prodn**. of **hydrogen** for **fuel**

cells)

L36 ANSWER 15 OF 22 HCA COPYRIGHT 2005 ACS on STN
134:210505 **Fuell cell** cooling apparatus and **fuel cell** system. Kimbara, Masahiko; Isogai, Yoshihiro (K. K. Toyoda Jidoshokki Seisakusho, Japan). Eur. Pat. Appl. EP 1081781 A2 **20010307**, 20 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO. (English). CODEN: EPXXDW. APPLICATION: EP 2000-118686 20000829. PRIORITY: JP 1999-243183 19990830.

AB A cooling app. for a **fuel cell** system having high cooling efficiency includes a chem. heat pump circuit (HP1) using iso-Pr alc., acetone, and hydrogen gas as a heat carrier. The chem. heat pump circuit includes an **endothermic** device incorporated in the **fuel cell** and an **exothermic** device for releasing heat from the circuit. The temp. of a heat carrier is increased to a first temp. by the heat of the **fuel cell**. The chem. heat pump circuit uses the heat of the heat carrier after it is heated to the first temp. to heat the heat carrier to a second temp., which is higher than the first temp. The heat of the heat carrier is used for other useful purposes or is simply desorbed. After the heat carrier is heated to the second temp., the heat carrier is easily cooled by a cooling fan. Thus, the cooling app. has a high cooling efficiency.

IT **1333-74-0P**, Hydrogen, uses
(**fuel cell** cooling app. and **fuel cell** system)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H— H

IC ICM H01M008-04

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** cooling app

IT Alloys, uses
(H-absorbing; **fuel cell** cooling app. and **fuel cell** system)

IT Heat pumps
(chem.; **fuel cell** cooling app. and **fuel cell** system)

IT Reactors
(**endothermic**; **fuel cell** cooling app. and **fuel cell** system)

IT Cooling apparatus
Exothermic reaction
Fuel cells

(**fuel cell** cooling app. and **fuel cell** system)

IT Hydrocarbons, reactions
(**fuel cell** cooling app. and **fuel cell** system)

IT Organic compounds, reactions
(hydrogenation; **fuel cell** cooling app. and **fuel cell** system)

IT Hydrogenation
(org. compd.; **fuel cell** cooling app. and **fuel cell** system)

IT Waste heat
(utilization; **fuel cell** cooling app. and **fuel cell** system)

IT 67-64-1P, Acetone, preparation 108-88-3P, Toluene, preparation
(**fuel cell** cooling app. and **fuel cell** system)

IT 67-63-0, Isopropyl alcohol, reactions 108-87-2, Methylcyclohexane
(**fuel cell** cooling app. and **fuel cell** system)

IT **1333-74-0P**, Hydrogen, uses
(**fuel cell** cooling app. and **fuel cell** system)

L36 ANSWER 16 OF 22 HCA COPYRIGHT 2005 ACS on STN

133:337415 Syngas production by steam reforming of natural gas in an autothermal countercurrent reactor. Frauhammer, J.; Kolios, G.; Eigenberger, G. (Universitat Stuttgart, Institut fur Chemische Verfahrenstechnik, Stuttgart, Germany). DGMK Tagungsbericht, 2000-3, 189-196 (English) **2000**. CODEN: DGTAF7. ISSN: 1433-9013. Publisher: Deutsche Wissenschaftliche Gesellschaft fuer Erdoel, Erdgas und Kohle.

AB Steam reforming has gained increasing interest as a hydrogen source for **fuel cells**. A compact reactor design is as important as a min. heat consumption. These demands trigger the development of autothermal reactors with integrated heat recovery. In the countercurrent reactor, the process gas and the fuel gas are fed countercurrently through the reactor. Methane steam reforming is performed under conditions of heat generation by methane combustion. Systematic anal. of the thermal behavior of the reactor under optimal operation shows that the reaction zones of the **endothermic** and the **exothermic** reaction must coincide along a substantial part of the reactor. The heat flux between the two sides must be uniform along the reaction zone.

IT **1333-74-0P, Hydrogen, preparation**
(syngas **prodn.** by steam reforming of natural gas in autothermal countercurrent reactor)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 49, 52, 67
IT Combustion
Fuel cells
Simulation and Modeling, physicochemical
(syngas prodn. by steam reforming of natural gas in autothermal countercurrent reactor)
IT 124-38-9P, Carbon dioxide, preparation 630-08-0P, Carbon monoxide, preparation **1333-74-0P, Hydrogen, preparation**
(syngas **prodn.** by steam reforming of natural gas in autothermal countercurrent reactor)

L36 ANSWER 17 OF 22 HCA COPYRIGHT 2005 ACS on STN
133:107405 Reformer, method of reforming, and **fuel cell** system. Aoyama, Satoshi (Toyota Jidosha Kabushiki Kaisha, Japan). Eur. Pat. Appl. EP 1020401 A1 **20000719**, 25 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO. (English). CODEN: EPXXDW. APPLICATION: EP 2000-100488 20000111. PRIORITY: JP 1999-6375 19990113.
AB A partial oxidn. reforming reaction occurs at the center of a chamber in a reformer, while a steam reforming reaction occurs in a localized manner around the chamber center. Thus, the efficiency of the reforming reaction is improved while keeping a low temp. in the vicinity of an outer chamber wall. Oxygen is supplied from an inlet center of the reformer to enhance a concn. of oxygen in a central area of the chamber. Steam is supplied along an outer wall of the chamber to enhance a concn. of steam in an outer peripheral area of the chamber. When a hydrocarbon is reformed in this state, a partial oxidn. reforming reaction which is an **exothermic** reaction mainly occurs in the central area, while a steam reforming reaction which is an **endothermic** reaction tends to occur in the outer peripheral area surrounding the central area. Thus, in the central area, the partial oxidn. reforming can be promoted by reaction heat that is generated. In the outer peripheral area, when the reaction heat produced in the central area diffuses, the reaction heat is absorbed to improve the efficiency of the steam reforming reaction while keeping a low temp. in the vicinity of the outer wall.
IT **1333-74-0P, Hydrogen, preparation**
(reformer for hydrocarbon reforming in **fuel cell** system)

RN 1333-74-0 HCA
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

IC ICM C01B003-38
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 47, 49, 51
ST hydrocarbon reformer **fuel cell** system
IT Synthesis gas manufacturing
(partial oxidn., steam reforming; reformer for hydrocarbon reforming in **fuel cell** system)
IT **Fuel cells**
Reforming apparatus
(reformer for hydrocarbon reforming in **fuel cell** system)
IT Hydrocarbons, reactions
Natural gas, reactions
(reformer for hydrocarbon reforming in **fuel cell** system)
IT 124-38-9, Carbon dioxide, reactions 630-08-0, Carbon monoxide, reactions
(reformer for hydrocarbon reforming in **fuel cell** system)
IT **1333-74-0P, Hydrogen, preparation**
(reformer for hydrocarbon reforming in **fuel cell** system)
IT 67-56-1, Methanol, reactions 74-82-8, Methane, reactions
7782-44-7, Oxygen, reactions
(reformer for hydrocarbon reforming in **fuel cell** system)
IT 7732-18-5, Water, reactions
(vapor; reformer for hydrocarbon reforming in **fuel cell** system)

L36 ANSWER 18 OF 22 HCA COPYRIGHT 2005 ACS on STN
132:210257 **Fuel cell** which operates with an excess of fuel. Thom, Frank (Forschungszentrum Julich G.m.b.H., Germany). PCT Int. Appl. WO 2000016423 A2 **20000323**, 18 pp. DESIGNATED STATES: W: AU, CA, JP, US; RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE. (German). CODEN: PIXXD2. APPLICATION: WO 1999-DE2932 19990911. PRIORITY: DE 1998-19841970 19980914; DE 1999-19941724 19990902.
AB The invention relates to a method for operating a **fuel cell**, comprising the following steps: a hydrocarbon-contg. fuel is fed into the inside of the **fuel cell** with a large excess; the hydrocarbon-contg. fuel is converted into a

synthesis gas internally and directly in or on the anode by means of an **endothermic** reaction; and the synthesis gas is only partially converted into electricity in the **fuel cell** by means of an **exothermic** electrochem. reaction. The heat produced by the **exothermic** reactions is advantageously, completely used up by the **endothermic** reactions. The aim is to achieve an almost isothermic stack-operating temp. It is also possible to limit the oxygen requirements of the electrochem. reactions to an almost stoichiometric dosage. In addn. to electricity, more valuable gases (**hydrogen**) are **produced**.

IT **1333-74-0P**, Hydrogen, uses
(**fuel cell** which operates with excess of fuel)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H—H

IC ICM H01M008-00

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** operation excess **fuel**

IT **Fuel cells**
Synthesis gas manufacturing
(**fuel cell** which operates with excess of fuel)

IT Natural gas, uses
(**fuel cell** which operates with excess of fuel)

IT 74-82-8, Methane, uses
(**fuel cell** which operates with excess of fuel)

IT **1333-74-0P**, Hydrogen, uses
(**fuel cell** which operates with excess of fuel)

L36 ANSWER 19 OF 22 HCA COPYRIGHT 2005 ACS on STN

132:209993 Fuel-flexible partial oxidation reforming of hydrocarbons for automotive applications. Kopasz, J. P.; Wilkenhoener, R.; Ahmed, S.; Carter, J. D.; Krumpelt, M. (Chemical Technology Division, Argonne National Laboratory, Argonne, IL, 60439, USA). Preprints of Symposia - American Chemical Society, Division of Fuel Chemistry, 44(4), 899-904 (English) **1999**. CODEN: PSADFZ. ISSN: 1521-4648. Publisher: American Chemical Society, Division of Fuel Chemistry.

AB Research is underway to develop **fuel cells** for ultra low emission vehicles. However, automotive and petroleum

companies have pointed out that the successful commercialization of **fuel cell** powered elec. vehicles in the near future will depend to a large extent on the availability of a refueling infrastructure. This infrastructure is completely lacking for H2. To tap into the existing fuel infrastructure, fuel processors capable of converting liq. hydrocabon fuels to H2 are required. Fuels of interest include gasoline, diesel, MeOH, EtOH, and natural gas. The overall partial oxidn. of autothermal catalytic reforming can be **exothermic** or **endothermic**. The main factor detg. the heat balance for the reaction is the O:C (or x/n) ratio. The thermal neutral point (where enthalpy of the reaction is zero) varies from an x/n ratio of 0.23 for MeOH to 0.37 for isooctane. For autothermal reforming, it is advantageous to run in the **exothermic** region, but at a low x/n ratio to maximize the yield of H2. The expts. reported here were performed with an x/n ratio of 0.5, except for MeOH and EtOH expts., which were performed at a lower x/n (0.32 and 0.25) to compensate for the O already present in the alc.

IT **1333-74-0P, Hydrogen, preparation**
(partial oxidn. reforming of hydrocarbon fuels for automotive applications)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H— H

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 49, 52, 67

ST hydrocarbon fuel partial oxidn automobile application; **hydrogen prodn** hydrocarbon fuel partial oxidn

IT 124-38-9P, Carbon dioxide, preparation 630-08-0P, Carbon monoxide, preparation **1333-74-0P, Hydrogen, preparation**
(partial oxidn. reforming of hydrocarbon fuels for automotive applications)

L36 ANSWER 20 OF 22 HCA COPYRIGHT 2005 ACS on STN

132:153982 Control apparatus and control method for reformer. Nagamiya, Kiyomi; Yamashita, Masashi; Yamaoka, Masaaki; Motozono, Yoshikazu (Toyota Jidosha Kabushiki Kaisha, Japan; Toyota Motor Co., Ltd.). Eur. Pat. Appl. EP 978476 A1 **20000209**, 14 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO. (English). CODEN: EPXXDW. APPLICATION: EP 1999-115224 19990802. PRIORITY: JP 1998-219470 19980803.

AB A control app. can maintain a substantially const. temp. of a reforming reaction in which a partial oxidn. reaction occurs. The

control app. can be used for a reformer that reforms reformate fuel into fuel by an **endothermic** reforming reaction and a partial oxidn. reforming reaction. The amt. of O2 supplied for the partial oxidn. reaction is detd. based on an amt. of the raw material and on theor. reaction heats of the **endothermal** and the **exothermal** reaction of the resp. reforming reaction and partial oxidn. reaction.

IC ICM C01B003-32
ICS B01J019-00; B01J008-02; B01J012-00

CC 49-1 (Industrial Inorganic Chemicals)
Section cross-reference(s): 52

IT **Fuel cells**
(control app. and control method for reforming in **manuf** . of **hydrogen** for)

L36 ANSWER 21 OF 22 HCA COPYRIGHT 2005 ACS on STN

131:146883 Non-reforming SOFC with high efficiency. Yamaji, Katsuhiko; Horita, Teruhisa; Sakai, Natsuko; Negishi, Hideyuki; Yokokawa, Harumi (National Institute of Materials and Chemical Research, Tsukuba, 305-8565, Japan). Proceedings - Electrochemical Society, 99-19(Solid Oxide Fuel Cells (SOFC VI)), 1027-1036 (English) **1999**. CODEN: PESODO. ISSN: 0161-6374. Publisher: Electrochemical Society.

AB Non-reforming but two-stage-oxidn. solid oxide **fuel cell** (SOFC) has been proposed and analyzed to realize high efficiency on a rather small scale without combination with any turbine system. This SOFC consists of the **endothermic** electrochem. reaction of hydrocarbons to form carbon monoxide and hydrogen and the **exothermic** electrochem. reaction of carbon monoxide and **hydrogen** to **form** carbon dioxide and water vapor. This can achieve high efficiency without reforming and therefore makes it possible to fabricate those SOFCs which can response quickly to the load change, can start up and shut down quickly, and can be compact enough to be used for transportation use, residential use, and co-generation. Discussions are made on the materials selection for realizing this SOFC, possible efficiency, technol. relationship with the reforming type SOFC or with the direct methane SOFC.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST solid oxide **fuel cell** nonreforming

IT Solid state **fuel cells**
(proposal of non-reforming solid oxide **fuel cells** with high efficiency)

L36 ANSWER 22 OF 22 HCA COPYRIGHT 2005 ACS on STN

107:81017 Electricity production from **fuel cells.** Pinto, Alwyn (Imperial Chemical Industries PLC, UK). Brit. UK Pat. Appl. GB 2182195 A1 **19870507**, 7 pp. (English). CODEN:

BAXXDU. APPLICATION: GB 1986-24126 19861008. PRIORITY: GB 1985-26055 19851022.

AB In a **fuel cell**, a hydrocarbon-contg. feedstock is reacted with steam to **produce** a **H**-contg. gas stream at superatm. pressure, the H-contg. gas stream is fed at this pressure to the **fuel-cell** anode gas space, air at superatm. pressure is fed to the **fuel-cell** cathode gas space, and at least the off gas from the **fuel-cell** anode gas space is led down through a turbine driving an air compressor compressing the air required in the cathode gas space. The hydrocarbon-contg. feedstock is reacted with steam and with air at superatm. pressure supplied by the compressor with the heat required for the **endothermic** reaction of the feedstock and steam being supplied by the **exothermic** reaction of the feedstock and air. The compressed air required is preheated by the heat exchange with the waste-gas stream, and the steam required is obtained by placing in contact the hydrocarbon-contg. feedstock or the air with a stream of hot water. Before being let down through the turbine, the off gas from the **fuel-cell** anode space is reacted with compressed air from the compressor to produce a heated waste-gas stream and heat is recovered from this stream by heat-exchange to preheat .gtoreq.1 of the above reactants. Two versions of the invention are described with ref. to the accompanying flow sheets.

IC ICM H01M008-06

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 48

ST **fuel cell** hydrogen air; hydrogen hydrocarbon steam **fuel cell**

IT **Fuel cells**
(power plants, hydrogen-air, with fuel reformers and turbine-driven air compressor)